



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION IX

75 Hawthorne Street
San Francisco, CA 94105-3901

November 30, 1998

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

Stephen L. Fleming, Director
Health, Safety and Environmental
AlliedSignal Inc., Engines
3131 E. Airline
Phoenix, Arizona 85034

Donald R. Netko, Director
Environmental, Health, Safety, and Remediation
Semiconductor Components Group
Motorola Inc.
3102 North 56th Street
Phoenix, AZ 85018

Re: Amended Order 98-15 pursuant to Section 106 of CERCLA, 42 USC §9606
Motorola 52nd Street Superfund Site

Dear Mr. Fleming and Mr. Netko:

The United States Environmental Protection Agency ("EPA") hereby issues the enclosed Amended Unilateral Administrative Order 98-15 pursuant to Section 106 of the Comprehensive Environmental Response, Compensation and Liability Act ("CERCLA"), 42 USC §9606, to implement the interim remedial action at the Motorola 52nd Street Site. The Amended Order requirements include construction, start-up, and two years of Operation & Maintenance of a groundwater extraction and treatment system for Operable Unit Two ("OU2"). This Amended Order is effective thirty (30) days after signature by EPA.

EPA and the Arizona Department of Environmental Quality ("ADEQ") have provided both companies ample time in which to reach an agreement to implement OU2. The Record of Decision was signed in July 1994 and ADEQ requested good faith offers to conduct the Remedial Design/Remedial Action in November of the same year. The Consent Decree, signed by ADEQ, Motorola, and the City of Phoenix in November 1996 covered only the Remedial Design, providing additional time for the parties to reach agreement concerning Remedial Action and Operation & Maintenance for OU2. In July 1998, ADEQ requested from Motorola and AlliedSignal good faith offers to complete the OU2 work. The original deadline of September 1998 was extended by approximately two months in order to allow the parties to participate in mediation and reach an agreement.

EPA issues this Amended Order because Motorola and AlliedSignal have not successfully reached agreement on OU2. We appreciate the time both companies spent to resolve your disputes and encourage you to continue to work together with the mediator towards that end. We remain hopeful that Motorola and AlliedSignal can enter into a Consent Decree with ADEQ for any remaining work. If a settlement cannot be reached prior to completion of the activities in the Amended Order, EPA, in its discretion may elect to address long-term Operation & Maintenance in a subsequent order. EPA will consider any failure to comply with this Amended Order in making any decisions concerning O&M.

The Amended Order provides for an opportunity to confer with EPA prior to implementation of the required response actions. As the holiday season is fast approaching, we suggest a meeting on either December 14 or 15. This proposed meeting will include both EPA and ADEQ and can be held in either San Francisco or Phoenix. Please contact either Nadia Hollan at (415) 744-2363 or Allyn Stern at (415) 744-1372 to discuss scheduling matters.

As the scope is limited to exclude most of the Operation & Maintenance, EPA and ADEQ fully expect Motorola and AlliedSignal to work together to fulfill the requirements of the Amended Order. If you have any questions regarding this Amended Order, please contact Ms. Hollan or Ms. Stern at the above phone numbers.

Sincerely,

A handwritten signature in black ink that reads "Keith Takata" followed by a horizontal flourish.

Keith Takata, Director
Superfund Division

cc: Maria Fant, Arizona Department of Environmental Quality
Linda Pollock, Attorney General's Office
Keith Bowers, AlliedSignal Inc.
David Campbell, Osborn Maledon
Tom Suriano, Motorola Inc.
Bob Copple, Motorola Inc.

AMENDED UNILATERAL ADMINISTRATIVE ORDER
MOTOROLA 52ND STREET SUPERFUND SITE

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UNITED STATES ENVIRONMENTAL PROTECTION
REGION 9

IN THE MATTER OF:

Motorola 52nd Street Superfund Site
Operable Unit 2

AlliedSignal Inc.,
Motorola Inc.,

Respondents.

Proceeding Under Section 106(a) of the
Comprehensive Environmental Response,
Compensation, and Liability Act of 1980,
as amended (42 U.S.C. § 9606(a))

U.S. EPA
Docket No.98-15

AMENDED ADMINISTRATIVE ORDER

I. INTRODUCTION AND JURISDICTION

1. This Amended Order directs Respondents to implement remedial action and two years of operation & maintenance for the interim remedy described in the Record of Decision for the Motorola 52nd Street Superfund site, Operable Unit Two dated July 21, 1994. This Amended Order replaces the Order issued on September 11, 1998 and is issued to Respondents by the United States Environmental Protection Agency ("EPA") under the authority vested in the President of the United States by section 106(a) of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as amended ("CERCLA"), 42 U.S.C. § 9606(a). This authority was delegated to the Administrator of EPA on January 23, 1987, by Executive Order 12580 (52 Fed. Reg. 2926, January 29, 1987), delegated to EPA Regional Administrators on September 13, 1987 by EPA Delegation No. 14-14-B, and further delegated to EPA Region 9 Superfund Division Director on September 29, 1997 by EPA Delegation No. 14-14-B.

II. FINDINGS OF FACT

2. The Motorola 52nd Street Superfund Site in Phoenix, Arizona includes the Motorola Semiconductor Products Sector Plant, located at 5005 East McDowell Road, and all areas where hazardous substances, pollutants or contaminants therefrom have come to be located or areas that are contributing to the contamination, including the AlliedSignal Aerospace Company, located at 111 South 34th Street. Releases of hazardous substances from the Motorola and AlliedSignal facilities have contributed to the ground water contamination at Operable Unit Two. The response activities are conducted in three study areas. EPA and ADEQ have addressed the contamination at this Site with interim remedies consisting of two operable units to date. Contamination not addressed by the two operable units continues to be investigated by EPA and ADEQ.

3. Respondent AlliedSignal Inc. ("AlliedSignal") is currently the owner and operator of the AlliedSignal Aerospace Company facility. AlliedSignal has been the owner and operator of the facility since 1952. The City of Phoenix owns and has owned a portion of the property on which the Allied Signal Aerospace Company is located. In 1952, AlliedSignal leased a portion of the AlliedSignal Aerospace Company property from the City of Phoenix. Since that time, AlliedSignal has either acquired or leased additional property to comprise the current boundaries of the facility.

4. The AlliedSignal facility has been used for manufacturing, repair, overhaul, testing, and storage of various aviation-related products. Solvents, including trichloroethylene ("TCE") and 1,1,1,-trichloroethane ("TCA"), were used to clean parts. TCE was also used as a refrigerant. AlliedSignal disposed of these solvents at the Site.

5. Respondent Motorola Inc. ("Motorola") is currently the owner and operator of the Motorola Semiconductor Products Sector Plant facility. Motorola has been the owner and operator of the facility since 1956.

6. As part of its electronics manufacturing operation, Motorola used solvents, including TCE and TCA to clean and degrease parts and equipment. Motorola disposed of these solvents at the Site.

7. On September 30, 1988, EPA signed the Record of Decision (ROD) for the Motorola 52nd Street Site Operable Unit One remedial action. This ROD served as EPA concurrence with the remedial action approved by the ADEQ.

8. On October 4, 1989, (54 Fed. Reg. 41,000), pursuant to section 105 of CERCLA, 42 U.S.C. § 9605, EPA placed the Motorola 52nd Street Site on the National Priorities List, set forth at 40 C.F.R. Part 300, Appendix B.

9. Pursuant to CERCLA Section 104(d)(1), 42 U.S.C. § 9604(d)(1), the Arizona Department of Environmental Quality (ADEQ) has authority to plan and implement response actions under the National Contingency Plan (NCP), 40 C.F.R. Part 300, at the Site.

10. In 1989, Motorola and the State of Arizona entered into a Consent Order requiring Motorola to design and implement a ground water treatment system at the Site for the purpose of containing the migration of solvents in soils and ground water from the plant to an area east of the Old Crosscut Canal at 46th street. This remedy, identified as the Operable Unit One Remedy, has been in operation since May 1992.

11. From about February 1992 to about October 1993, Motorola, in conjunction with ADEQ and EPA, undertook a Remedial Investigation and Feasibility Study ("RI/FS") for Operable Unit Two, pursuant to CERCLA and the NCP.

12. Pursuant to section 117 of CERCLA, 42 U.S.C. § 9617, ADEQ published notice of the completion of the Operable Unit Two FS and of the proposed plan for interim remedial action on January 5, 1994, and provided opportunity for public comment on the proposed interim remedial action.

13. The decision by EPA on the interim remedial action to be implemented at the Motorola 52nd Street Site Operable Unit Two is embodied in a final Record of Decision ("ROD"), executed by ADEQ on July 1, 1994 and by EPA on July 21, 1994. The interim remedial action selected by this ROD includes the extraction, treatment, and beneficial end-use of ground water in the vicinity of Interstate 10 and Van Buren Street. The ROD is attached to this Amended Order as Attachment A and is incorporated by reference. The ROD is supported by an administrative record that contains the documents and information upon which EPA based the selection of the response action.

14. The interim remedial action described in the ROD addresses the principal threat and primary risk at Operable Unit Two by establishing a capture zone across the entire width and depth of the contaminant plume and to reduce concentrations of contaminated groundwater.

15. On April 9, 1997, Motorola, the City of Phoenix and the State of Arizona entered into a Consent Decree (OU 2 RD Consent Decree) requiring, in part, that Motorola develop final plans and specifications for a ground water extraction, containment and

treatment system for Operable Unit Two. Pursuant to the Decree, Motorola has reimbursed the State of Arizona for its past response costs incurred at the Site and agreed to reimburse the State for its future response costs in overseeing the design work for Operable Unit Two. The City of Phoenix contributed a cash payment toward the Remedial Design. Motorola has completed 90% of the design for Operable Unit Two. It is currently under review by EPA and ADEQ.

16. This Amended Order addresses the Remedial Action and two years of Operation & Maintenance for Operable Unit Two.

17. The ground water within Operable Unit Two is contaminated with volatile organic compounds (VOCs) including, TCE and its degradation by-product 1,2-dichloroethylene (1,2-DCE), tetrachloroethylene(PCE), and TCA and its degradation by-products, 1,1-dichloroethylene (1,1-DCE), and 1,1-dichloroethane (1,1-DCA). The soil and ground water are also contaminated with vinyl chloride, which is a degradation by-product of both TCA and TCE.

18. The Remedial Investigation for OU 1 identified 25 potential source areas at the Motorola facility. The three main areas targeted for cleanup were the Courtyard, Acid Treatment Plant, and the Southwest Parking Lot.

19. Motorola and ADEQ have conducted significant amounts of groundwater sampling at and downgradient from the Motorola facility. In 1991, TCE was detected in groundwater at the Site in levels up to 4,100,000 ppb and TCA was detected in levels up to 271,000 ppb.

20. In 1982, Motorola discovered a leaking 5,000 gallon underground storage tank containing TCA at its facility. A

preliminary investigation for soil and groundwater contamination also revealed releases of TCA and other VOC's.

21. A Preliminary Assessment (PA) was completed in June 1983 and a Preliminary Re-Assessment (PRA), was completed on September 1, 1993 at the AlliedSignal facility. The PRA identified potential source areas at the AlliedSignal facility, including a solvent storage area, the low altitude cooling chamber, and fifteen satellite drum accumulation areas.

22. Sample results from ground water monitoring wells located on and around the AlliedSignal facility have shown VOC contamination, with levels of 1,1,1-TCA up to 40,000 ug/l, 1,1-DCE up to 5,000 ug/l, 1,2-DCE up to 700 ug/l, TCE up to 500 ug/l, and vinyl chloride up to 1500 ug/l, all significantly in excess of drinking water standards.

23. August 1997 soil gas sampling at the Allied facility solvent storage area shows levels of TCA up to 1390 ug/l in the deep samples and up to 790 ug/l in the shallow samples. TCE was detected up to 84 ug/L in the deep samples and up to 390 ug/l at the shallow sampling depth. Both TCE and TCA were detected at every depth measured in the soil samples. 1,1-DCA, and 1,1-DCE were also detected in elevated levels in both shallow and deep soils.

24. On August 2, 1984, AlliedSignal reported a spill of TCE from a valve on the low altitude cooling chamber. In response to this spill, some soil was excavated and the remaining soil was cleaned to a maximum of 35 ppb of TCE.

25. The Allied facility also contained fifteen satellite accumulation areas that were used as temporary collection sites for 55-gallon drums of solvent. Each area has a storm drain for

drainage of chemicals. According to the PRA, the drum areas were not well maintained and the concrete was visibly stained in the drum areas. In addition, the PRA states that the storm drains appeared full of leaked solvents from tanks containing solvents, including TCA.

26. Ground water contaminated with TCE and 1,2,-DCE flows from the Motorola facility in a west-southwest direction and directly underneath and down gradient from the AlliedSignal facility. Ground water monitoring wells at and down gradient from the AlliedSignal facility also show elevated levels of TCE, 1,2,-DCE, TCA, 1,1-DCE, and vinyl chloride contamination.

27. The Site contains a mixture of commercial, industrial and residential properties. The nearest residences are less than 100 feet from the western property boundary of the Motorola facility. The AlliedSignal facility is located immediately north of the Phoenix Sky Harbor Airport and one mile from the Salt River. The wells located on the Site are currently used for commercial, industrial, and agricultural purposes, but could potentially be used as a source of drinking water.

28. The Baseline Risk Assessment for this Site demonstrates that the potential risk from exposure to contaminated ground water is greater than the 1×10^{-4} (one in 10,000), the upper limit of the generally acceptable risk range specified in the National Contingency Plan.

III. CONCLUSIONS OF LAW AND DETERMINATIONS

29. The Motorola 52nd Street Site, the Motorola Semiconductor Products Plant, and the AlliedSignal Aerospace Company are each a "facility" as defined in section 101(9) of CERCLA, 42 U.S.C. § 9601(9).

30. Respondents are each a "person" as defined in section 101(21) of CERCLA, 42 U.S.C. § 9601(21).

31. Respondents are each a "liable party" as defined in section 107(a) of CERCLA, 42 U.S.C. § 9607(a), and is subject to this Amended Order under section 106(a) of CERCLA, 42 U.S.C. § 9606(a).

32. The substances listed in paragraph 17 are found at the Site, including Operable Unit Two, and are "hazardous substances" as defined in section 101(14) of CERCLA, 42 U.S.C. § 9601(14).

33. These hazardous substances have been and/or are being released from the Motorola and AlliedSignal facilities into the soil and ground water of Operable Unit Two of the Site.

34. The past and present disposal and migration of hazardous substances from the Site, including Operable Unit Two, are a "release" as defined in section 101(22) of CERCLA, 42 U.S.C. § 9601(22).

35. The release or threat of release of one or more hazardous substances from Operable Unit Two, including the AlliedSignal and Motorola facilities, may present an imminent and substantial endangerment to the public health or welfare or the environment.

36. The contamination and endangerment at Operable Unit Two and this Site constitute an indivisible injury. The actions required

by this Amended Order are necessary to protect the public health, welfare, and the environment.

IV. NOTICE TO THE STATE

37. EPA notified the State of Arizona, Department of Environmental Quality, of the issuance of this Amended Order by sending a copy of this Amended Order to ADEQ by US mail.

V. ORDER

38. Based on the foregoing, Respondents are hereby ordered to comply with the following provisions, including but not limited to all attachments to this Amended Order, all documents incorporated by reference into this Amended Order, and all schedules and deadlines in this Amended Order, attached to this Amended Order, or incorporated by reference into this Amended Order:

VI. DEFINITIONS

39. Unless otherwise expressly provided herein, terms used in this Amended Order which are defined in CERCLA or in regulations promulgated under CERCLA shall have the meaning assigned to them in the statute or its implementing regulations. Whenever terms listed below are used in this Amended Order or in the documents attached to this Amended Order or incorporated by reference into this Amended Order, the following definitions shall apply:

a. "CERCLA" shall mean the Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as amended, 42 U.S.C. §§ 9601 et seq.

b. "Day" shall mean a calendar day unless expressly stated to be a working day. "Working day" shall mean a day other than a Saturday, Sunday, or Federal holiday. In computing any period of time under this Amended Order, where the last day would fall on a

Saturday, Sunday, or Federal holiday, the period shall run until the end of the next working day.

c. "EPA" shall mean the United States Environmental Protection Agency.

d. "ADEQ" shall mean the Arizona Department of Environmental Quality.

e. "National Contingency Plan" or "NCP" shall mean the National Contingency Plan promulgated pursuant to Section 105 of CERCLA, 42 U.S.C. § 9605, codified at 40 C.F.R. Part 300, including any amendments thereto.

f. "Operation and Maintenance" or "O&M" shall mean all activities required under the Operation and Maintenance Plan developed by Respondents pursuant to this Amended Order and the Statement of Work, and approved by EPA.

g. "Operable Unit One" or "OU 1" shall mean the area addressed by the Remedial Investigation Report for OU 1, dated June 1987.

h. "Operable Unit Two" or "OU 2" shall mean the area described more fully in the OU 2 Record of Decision for the Site dated July 21, 1994, in the attached Statement of Work, and any additional areas requiring response action pursuant to this Amended Order.

i. "Paragraph" shall mean a portion of this Amended Order identified by an Arabic numeral.

j. "Performance Standards" shall mean those cleanup standards, including treatment and hydraulic containment standards, standards of control, and other substantive requirements, criteria or limitations, identified in the Record of Decision and Statement of Work, that the Remedial Action and Work required by this Amended Order must attain and maintain.

k. "Record of Decision" or "ROD" shall mean the EPA Record of Decision relating to the Site, Operable Unit Two , signed on July 21, 1994 by the Regional Administrator, EPA Region IX, and by ADEQ on July 1, 1994, and all attachments, amendments, or explanation of significant differences ("ESD") thereto.

l. "Remedial Action" or "RA" shall mean those activities to be undertaken by Respondents to implement the final plans and specifications submitted to EPA pursuant to the Remedial Design Work Plan approved by ADEQ and EPA, the attached Statement of Work, and any additional activities required under Sections X, XI, XII, XIII, and XIV of this Amended Order.

m. "Remedial Design" or "RD" shall mean the final plans and specifications for the Remedial Action pursuant to the Remedial Design Work Plan.

n. "Respondents" shall mean Motorola Inc. and AlliedSignal Inc.

o. "Response Costs" shall mean all costs, including direct costs, indirect costs, and accrued interest incurred by the United States to perform or support response actions at the Site. Response costs include but are not limited to the costs of overseeing the Work, such as the costs of reviewing or developing

plans, reports and other items pursuant to this Amended Order and costs associated with verifying the Work.

p. "Statement of Work" or "SOW" shall mean the statement of work for implementation of the Remedial Action and two years of Operation and Maintenance at Operable Unit Two, as set forth in Attachment B to this Amended Order. The Statement of Work and all attachments, thereto are incorporated into this Amended Order and are an enforceable part of this Amended Order.

q. "Section" shall mean a portion of this Amended Order identified by a roman numeral and includes one or more paragraphs.

r. "Site" shall mean the Motorola 52nd Street Superfund site, in Phoenix, Arizona, as described on the National Priorities List, and including any areas where hazardous substances, pollutants or contaminants therefrom have come to be located or areas that are contributing to the contamination, including the Motorola and AlliedSignal facilities.

s. "State" shall mean the State of Arizona.

t. "United States" shall mean the United States of America.

u. "Work" shall mean all activities Respondents are required to perform under this Amended Order to implement the ROD for Operable Unit Two, including Remedial Action, Operation & Maintenance, and any activities required to be undertaken pursuant to Sections VII through XXIV, and XXVII of this Amended Order.

VII. NOTICE OF INTENT TO COMPLY

40. Respondents shall provide, not later than five (5) days after the effective date of this Amended Order, written notice to EPA's Remedial Project Manager (RPM) stating whether they will comply with the terms of this Amended Order. If Respondents do not unequivocally commit to perform the Work as provided by this Amended Order, they shall be deemed to have violated this Amended Order and to have failed or refused to comply with this Amended Order. Respondents' written notice shall describe, using facts that exist on or prior to the effective date of this Amended Order, any "sufficient cause" defenses asserted by Respondents under sections 106(b) and 107(c)(3) of CERCLA. The absence of a response by EPA to the notice required by this paragraph shall not be deemed to be acceptance of Respondents' assertions.

VIII. PARTIES BOUND

41. This Amended Order shall apply to and be binding upon the Respondents, their directors, officers, employees, agents, successors, and assigns. No change in the ownership, corporate status, or other control of the Respondents shall alter any of the Respondents' responsibilities under this Amended Order.

42. Respondents shall provide a copy of this Amended Order to any prospective owners or successors before a controlling interest in Respondents' assets, property rights, or stock are transferred to the prospective owner or successor. Respondents shall provide a copy of this Amended Order to each contractor, sub-contractor, laboratory, or consultant retained to perform any Work under this Amended Order, within five days after the effective date of this Amended Order or on the date such services are retained, whichever date occurs later. Respondents shall also provide a copy of this Amended Order to each person representing any Respondent with respect to Operable Unit Two or the Work and shall condition all

contracts and subcontracts entered into hereunder upon performance of the Work in conformity with the terms of this Amended Order. With regard to the activities undertaken pursuant to this Amended Order, each contractor and subcontractor shall be deemed to be related by contract to the Respondents within the meaning of section 107(b)(3) of CERCLA, 42 U.S.C. § 9607(b)(3). Notwithstanding the terms of any contract, Respondents are responsible for compliance with this Amended Order and for ensuring that their contractors, subcontractors and agents comply with this Amended Order, and perform any Work in accordance with this Amended Order.

43. Within five (5) days after the effective date of this Amended Order, each Respondent that owns real property comprising all or part of the Site shall record a copy or copies of this Amended Order in the appropriate governmental office where land ownership and transfer records are filed or recorded, and shall ensure that the recording of this Amended Order is indexed to the titles of each and every property at the Site so as to provide notice to third parties of the issuance and terms of this Amended Order with respect to those properties. Each Respondent that owns real property shall, within 15 days after the effective date of this Amended Order, send notice of such recording and indexing to EPA.

44. Not later than sixty (60) days prior to any transfer of any real property interest in any property included within the Site, Respondent that transfers such property shall submit a true and correct copy of the transfer document(s) to EPA, and shall identify the transferee by name, principal business address and effective date of the transfer.

IX. WORK TO BE PERFORMED

45. Respondents shall cooperate with EPA in providing information regarding the Work to the public. As requested by EPA, Respondents shall participate in the preparation of such information for distribution to the public and in public meetings which may be held or sponsored by EPA to explain activities at or relating to Operable Unit Two.

46. All aspects of the Work to be performed by Respondents pursuant to this Amended Order shall be under the direction and supervision of a qualified Supervising Contractor the selection of which shall be subject to approval by EPA. Within thirty (30) days after the effective date of this Amended Order, Respondents shall notify EPA in writing of the name and qualifications of the Supervising Contractor, including primary support entities and staff, proposed to be used in carrying out Work under this Amended Order. If at any time Respondents propose to use a different Supervising Contractor, Respondents shall notify EPA and shall obtain approval from EPA before the new Supervising Contractor performs any Work under this Amended Order.

47. EPA will review Respondents' selection of a Supervising Contractor according to the terms of this paragraph and the SOW. If EPA disapproves of the selection of the Supervising Contractor, Respondents shall submit to EPA within 15 days after receipt of EPA's disapproval of the Supervising Contractor previously selected, a list of Supervising Contractors, including primary support entities and staff, that would be acceptable to Respondents. EPA will thereafter provide written notice to Respondents of the names of the Supervising Contractors that are acceptable to EPA. Respondents may then select any approved Supervising Contractor from that list and shall notify EPA of the

name of the Supervising Contractor selected within 30 days of EPA's designation of approved Supervising Contractors.

B. Remedial Action

48. In accordance with the schedule set forth in the SOW, Respondents shall submit a Remedial Action Work Plan (RA Work Plan) to EPA for review and approval. The RA Work Plan shall be developed in accordance with the ROD, and the attached Statement of Work, and shall be consistent with the Final Remedial Design as approved by EPA. The RA Work Plan shall include the elements as identified in the SOW and shall be completed in accordance with the schedule identified as Attachment 1 to the SOW. Respondents shall also submit to EPA for review, in accordance with the SOW and Attachment 1 to the SOW at least the following: (1) Site Management Plan; (2) Health and Safety Plan; (3) Sampling and Analysis Plan; (4) Quality Assurance Project Plan; (5) Field Sampling Plan; (6) Data Management Plan; (7) Pollution Control & Mitigation Plan; (8) Waste Management Plan; (9) Construction Quality Assurance Plan; (10) Operation & Maintenance Manual; (11) Start-up Monitoring Plan; and (12) Contingency Plan. The Health and Safety Plan for field activities shall conform to applicable Occupational Safety and Health Administration and EPA requirements, including but not limited to the regulations at 54 Fed. Reg. 9294.

49. Upon approval by EPA, the Final RA Work Plan is incorporated into this Amended Order as a requirement of this Amended Order and shall be an enforceable part of this Amended Order.

50. Upon approval of the RA Work Plan by EPA, Respondents shall implement the RA Work Plan according to the schedules in the RA Work Plan. Unless otherwise directed by EPA, Respondents shall not commence remedial action at the Site prior to approval of the RA Work Plan.

51. If Respondents seek to retain a construction contractor or any subcontractor to assist in the performance of the Work, then Respondents shall submit a copy of the contractor solicitation documents to EPA not later than five (5) days after publishing the solicitation documents.

52. Prior to submission of the Final RA Work Plan, Respondents shall notify EPA in writing of the name, title, and qualifications of any construction contractor proposed to be used in carrying out work under this Amended Order. If at any time Respondents propose to change the construction contractor, Respondents shall notify EPA before the new construction contractor performs any work under this Amended Order.

53. The Work performed by Respondents pursuant to this Amended Order shall, at a minimum, achieve the Performance Standards specified in the Record of Decision and the Statement of Work.

54. Notwithstanding any action by EPA, Respondents remain fully responsible for achievement of the Performance Standards in the Record of Decision and Statement of Work. Nothing in this Amended Order, or in EPA's approval of the Statement of Work, or in the Remedial Design or Remedial Action Work Plans, or approval of any other submission, shall be deemed to constitute a warranty or representation of any kind by EPA that full performance of the Work will achieve the Performance Standards set forth in the ROD and in the Statement of Work. Respondents' compliance with such approved documents does not foreclose EPA from seeking additional work to achieve the applicable performance standards.

55. Respondents shall, prior to any off-site shipment of hazardous substances from the Site to an out-of-state waste management facility, provide written notification to the appropriate state

environmental official in the receiving state and to EPA's RPM of such shipment of hazardous substances. However, the notification of shipments shall not apply to any off-Site shipments when the total volume of all shipments from the Site to the receiving state will not exceed ten (10) cubic yards.

a. The notification shall be in writing, and shall include the following information, where available: (1) the name and location of the facility to which the hazardous substances are to be shipped; (2) the type and quantity of the hazardous substances to be shipped; (3) the expected schedule for the shipment of the hazardous substances; and (4) the method of transportation. Respondents shall notify the receiving state of major changes in the shipment plan, such as a decision to ship the hazardous substances to another facility within the same state, or to a facility in another state.

b. The identity of the receiving facility and state will be determined by Respondents following the award of the contract for Remedial Action construction. Respondents shall provide all relevant information, including information under the categories noted in paragraph 53.a above, on the off-Site shipments as soon as practicable after the award of the contract and before the hazardous substances are actually shipped.

56. In accordance with Section 7.1 of the SOW, within fifteen (15) days after completion of construction and operational testing of the treatment system, Respondents shall so notify EPA and shall schedule and conduct a pre-certification inspection to be attended by Respondents and EPA. The pre-certification inspection shall be followed by a written report submitted within thirty (30) days of the inspection by a registered professional engineer and Respondents' Project Coordinator certifying that the construction

and operational testing of the treatment system has been completed in full satisfaction of the requirements of this Amended Order. If, after completion of the pre-certification inspection, receipt and review of the written report, and after Respondents have completed Sections 7.0 through 9.0 of the SOW, EPA determines that the Work, or any portion thereof has not been completed in accordance with this Amended Order, EPA shall notify Respondents in writing of the activities that must be undertaken and shall set forth in the notice a schedule for performance of such activities. Respondents shall perform all activities described in the notice in accordance with the specifications and schedules established therein. If EPA concludes, following the initial or any subsequent certification of completion by Respondents that the Remedial Action has been fully performed in accordance with this Amended Order, EPA may notify Respondents that the Remedial Action has been fully performed. EPA's notification shall be based on present knowledge and Respondents' certification to EPA, and shall not limit EPA's right to perform periodic reviews pursuant to section 121(c) of CERCLA, 42 U.S.C. § 9621(c), or to take or require any action that in the judgment of EPA is appropriate at the Site, in accordance with 42 U.S.C. §§ 9604, 9606, or 9607.

X. FAILURE TO ATTAIN PERFORMANCE STANDARDS

57. In the event that EPA determines that additional response activities are necessary to meet applicable Performance Standards, EPA may notify Respondents that additional response actions are necessary.

58. Unless otherwise stated by EPA, within thirty (30) days of receipt of notice from EPA that additional response activities are necessary to meet any applicable Performance Standards, Respondents shall submit for approval by EPA a work plan for the additional response activities. The plan shall conform to the applicable

requirements of sections IX, XVI, and XVII of this Amended Order. Upon EPA's approval of the plan pursuant to Section XIV, Respondents shall implement the plan for additional response activities in accordance with the provisions and schedule contained therein.

XI. EPA PERIODIC REVIEW

59. Under section 121(c) of CERCLA, 42 U.S.C. § 9621(c), and any applicable regulations, EPA may review the Site to assure that the Work performed pursuant to this Amended Order adequately protects human health and the environment. As a result of any review performed under this paragraph, Respondents may be required to perform additional Work or to modify Work previously performed.

XII. ADDITIONAL RESPONSE ACTIONS

60. EPA may determine that in addition to the Work identified in this Amended Order and attachments to this Amended Order, additional response activities may be necessary to protect human health and the environment. If EPA determines that additional response activities are necessary, EPA may require Respondents to submit a work plan for additional response activities. EPA may also require Respondents to modify any plan, design, or other deliverable required by this Amended Order, including any approved modifications.

61. Not later than thirty (30) days after receiving EPA's notice that additional response activities are required pursuant to this Section, Respondents shall submit a work plan for the response activities to EPA for review and approval. Upon approval by EPA, the work plan is incorporated into this Amended Order as a requirement of this Amended Order and shall be an enforceable part of this Amended Order. Upon approval of the work plan by EPA, Respondents shall implement the work plan according to the

standards, specifications, and schedule in the approved work plan. Respondents shall notify EPA of their intent to perform such additional response activities within seven (7) days after receipt of EPA's request for additional response activities.

XIII. ENDANGERMENT AND EMERGENCY RESPONSE

62. In the event of any action or occurrence during the performance of the Work which causes or threatens to cause a release of a hazardous substance or which may present an immediate threat to public health or welfare or the environment, Respondents shall immediately take all appropriate action to prevent, abate, or minimize the threat, and shall immediately notify EPA's Remedial Project Manager (RPM) or, if the RPM is unavailable, EPA's Alternate RPM. If neither of these persons is available Respondents shall notify the EPA Emergency Response Unit, Region IX. Respondents shall take such action in consultation with EPA's RPM and in accordance with all applicable provisions of this Amended Order, including but not limited to the Health and Safety Plan and the Contingency Plan. In the event that Respondents fail to take appropriate response action as required by this Section, and EPA takes that action instead, Respondents shall reimburse EPA for all costs of the response action not inconsistent with the NCP. Respondents shall pay the response costs in the manner described in Section XXIV of this Amended Order, within thirty (30) days of Respondents' receipt of demand for payment and a cost summary report of the costs incurred.

63. Nothing in the preceding paragraph shall be deemed to limit any authority of the United States to take, direct, or order all appropriate action to protect human health and the environment or to prevent, abate, or minimize an actual or threatened release of hazardous substances on, at, or from the Site.

XIV. EPA REVIEW OF SUBMISSIONS

64. Any deliverable, plan, report or other item that is required to be submitted for review and approval pursuant to this Amended Order shall be reviewed by EPA and ADEQ. After such review, EPA may: (a) approve the submission; (b) approve the submission with modifications; (c) disapprove the submission and direct Respondents to re-submit the document after incorporating EPA's or ADEQ's comments; or (d) disapprove the submission and assume responsibility for performing all or any part of the response action. As used in this Amended Order, the terms "approval by EPA," "EPA approval," or a similar term means the action described in (a) or (b) of this paragraph.

65. In the event of approval or approval with modifications by EPA, Respondents shall proceed to take any action required by the plan, report, or other item, as approved or modified by EPA.

66. Upon receipt of a notice of disapproval or a request for a modification, Respondents shall, within twenty-one (21) days or such longer time as specified by EPA in its notice of disapproval or request for modification, correct the deficiencies and resubmit the plan, report, or other item for approval. Notwithstanding the notice of disapproval, or approval with modifications, Respondents shall proceed, at the direction of EPA, to take any action required by any non-deficient portion of the submission.

67. If any submission is not approved by EPA, Respondents shall be deemed to be in violation of this Amended Order.

XV. PROGRESS REPORTS

68. In addition to the other deliverables set forth in this Amended Order and the SOW, Respondents shall provide monthly progress reports to EPA with respect to actions and activities

undertaken pursuant to this Amended Order. The progress reports shall be submitted on or before the 15th day of each month following the effective date of this Amended Order. At a minimum these progress reports shall: (1) describe the actions which have been taken to comply with this Amended Order during the prior month; (2) include all results of sampling and tests and all other data received by Respondents and not previously submitted to EPA; (3) describe all work planned for the next forty-five (45) days with schedules relating such work to the overall project schedule for Work completion; and (4) describe all problems encountered and any anticipated problems, any actual or anticipated delays, and solutions developed and implemented to address any actual or anticipated problems or delays.

XVI. QUALITY ASSURANCE, SAMPLING AND DATA ANALYSIS

69. Respondents shall use the quality assurance, quality control, and chain of custody procedures described in the "EPA NEIC Policies and Procedures Manual," May 1978, revised August 1991, EPA-330/9-78-001-R; EPA's "EPA Requirements for Quality Management Plans," EPA QA/R-2, Interim Final, August 1994; EPA's "Data Quality Objectives Process for Superfund," (EPA-540-R-93-071), September 1993; "EPA Requirements for Quality Assurance Project Plans for Environmental Data Operations," QA/R-5, Draft Interim Final, August 1994; and any amendments or revisions to these documents, while conducting all sample collection and analysis activities required herein by any plan. To provide quality assurance and maintain quality control, Respondents shall:

- a. Use only laboratories which have a documented Quality Assurance Program that complies with EPA QA/R-5.
- b. Ensure that the laboratory used by the Respondents for analyses, performs according to a method or methods deemed satisfactory to EPA and submits all protocols to be used for analyses to EPA at least 30 days before beginning analysis.

- c. Ensure that EPA personnel and EPA's authorized representatives are allowed access to the laboratory and personnel utilized by the Respondents for analyses.

70. Respondents shall notify EPA not less than twenty-one (21) days in advance of any sample collection activity. At the request of EPA, Respondents shall allow split or duplicate samples to be taken by EPA or its authorized representatives, of any samples collected by Respondents with regard to the Site or pursuant to the implementation of this Amended Order. In addition, EPA shall have the right to take any additional samples that EPA deems necessary.

XVII. COMPLIANCE WITH APPLICABLE LAWS

71. All activities by Respondents pursuant to this Amended Order shall be performed in accordance with the requirements of all Federal and state laws and regulations. EPA has determined that the activities contemplated by this Amended Order are consistent with the National Contingency Plan (NCP).

72. Except as provided in section 121(e) of CERCLA and the NCP, no permit shall be required for any portion of the Work conducted entirely on-Site. Where any portion of the Work requires a Federal or state permit or approval, Respondents shall submit timely applications and take all other actions necessary to obtain and to comply with all such permits or approvals.

73. This Amended Order is not, and shall not be construed to be, a permit issued pursuant to any Federal or state statute or regulation.

74. All materials removed from the Site shall be disposed of or treated at a facility approved by EPA's RPM and in accordance with section 121(d)(3) of CERCLA, 42 U.S.C. § 9621(d)(3); with the U.S.

EPA "Revised Off-Site policy," 40 CFR section 300.440; and with all other applicable Federal, state, and local requirements.

XVIII. REMEDIAL PROJECT MANAGER

75. All communications, whether written or oral, from Respondents to EPA shall be directed to EPA's Remedial Project Manager or Alternate Remedial Project Manager. The RPM may also designate additional persons to whom Respondents shall submit documents or other communications. Respondents shall submit to EPA the original and four copies of all documents, including plans, reports, and other correspondence, which are developed pursuant to this Amended Order, and shall send these documents by certified mail or overnight mail, as requested by the RPM.

EPA's Remedial Project Manager is:

Nadia Hollan
U.S. Environmental Protection Agency
75 Hawthorne Street (SFD-7-1)
San Francisco, CA 94105
(415) 744-2363

EPA's Alternate Remedial Project Manager is:

Michael Montgomery
U.S. Environmental Protection Agency
75 Hawthorne Street (SFD-7-1)
San Francisco, CA 94105
(415) 744-2362

76. EPA has the unreviewable right to change its Remedial Project Manager or Alternate Remedial Project Manager. If EPA changes its Remedial Project Manager or Alternate Remedial Project Manager, EPA

will inform Respondents in writing of the name, address, and telephone number of the new Remedial Project Manager or Alternate Remedial Project Manager.

77. EPA's RPM and Alternate RPM shall have the authority lawfully vested in a Remedial Project Manager (RPM) and On-Scene Coordinator (OSC) by the National Contingency Plan, 40 C.F.R. Part 300. EPA's RPM or Alternate RPM shall have authority, consistent with the National Contingency Plan, to halt any work required by this Amended Order, and to take any necessary response action.

78. Within five (5) days after the effective date of this Amended Order, Respondents shall designate a Project Coordinator and shall submit the name, address, and telephone number of the Project Coordinator to EPA for review and approval. Respondents' Project Coordinator shall be responsible for overseeing Respondents' implementation of this Amended Order. If Respondents wish to change his/her Project Coordinator, Respondents shall provide written notice to EPA, five (5) days prior to changing the Project Coordinator, of the name and qualifications of the new Project Coordinator. Respondents' selection of a Project Coordinator shall be subject to EPA approval.

XIX. ACCESS TO SITE NOT OWNED BY RESPONDENTS

79. If the Site, the off-Site area that is to be used for access, property where documents required to be prepared or maintained by this Amended Order are located, or other property subject to or affected by the clean up, is owned in whole or in part by parties other than those bound by this Amended Order, Respondents will obtain, or use their best efforts to obtain, site access agreements from the present owner(s) within thirty (30) days of the effective date of this Amended Order. Such agreements shall

provide access for EPA, its contractors and oversight officials, the State and its contractors, and Respondents or Respondents' authorized representatives and contractors, and such agreements shall specify that Respondents are not EPA's representative with respect to liability associated with Operable Unit Two activities. Respondents shall save and hold harmless the United States and its officials, agents, employees, contractors, subcontractors, or representatives for or from any and all claims or causes of action or other costs incurred by the United States including but not limited to attorneys fees and other expenses of litigation and settlement arising from or on account of acts or omissions of Respondents, their officers, directors, employees, agents, contractors, subcontractors, and any persons acting on their behalf or under their control, in carrying out activities pursuant to this Amended Order, including any claims arising from any designation of Respondents as EPA's authorized representative(s) under section 104(e) of CERCLA. Copies of such agreements shall be provided to EPA prior to Respondents' initiation of field activities. Respondents' best efforts shall include providing reasonable compensation to any off-Site property owner. If access agreements are not obtained within the time referenced above, Respondents shall immediately notify EPA of its failure to obtain access. Subject to the United States' non-reviewable discretion, EPA may use its legal authorities to obtain access for the Respondents, may perform those response actions with EPA contractors at the property in question, or may terminate the Amended Order if Respondents cannot obtain access agreements. If EPA performs those tasks or activities with contractors and does not terminate the Amended Order, Respondents shall perform all other activities not requiring access to that property, and shall reimburse EPA, pursuant to Section XXIV of this Amended Order, for all costs incurred in performing such activities. Respondents shall integrate the results of any such tasks undertaken by EPA into its reports and

deliverables. Respondents shall reimburse EPA, pursuant to Section XXIV of this Amended Order, for all response costs (including attorney fees) incurred by the United States to obtain access for Respondents.

XX. SITE ACCESS AND DATA/DOCUMENT AVAILABILITY

80. Respondents shall allow EPA and its authorized representatives and contractors to enter and freely move about all property at the Site and off-Site areas subject to or affected by the work under this Amended Order or where documents required to be prepared or maintained by this Amended Order are located, for the purposes of inspecting conditions, activities, the results of activities, records, operating logs, and contracts related to the Site or Respondents and their representatives or contractors pursuant to this Amended Order; reviewing the progress of the Respondents in carrying out the terms of this Amended Order; conducting tests as EPA or its authorized representatives or contractors deem necessary; using a camera, sound recording device or other documentary type equipment; and verifying the data submitted to EPA by Respondents. Respondents shall allow EPA and its authorized representatives to enter the Site, to inspect and copy all records, files, photographs, documents, sampling and monitoring data, and other writings related to work undertaken in carrying out this Amended Order. Nothing herein shall be interpreted as limiting or affecting EPA's right of entry or inspection authority under Federal law.

81. Respondents may assert a claim of business confidentiality covering part or all of the information submitted to EPA pursuant to the terms of this Amended Order under 40 C.F.R. § 2.203, provided such claim is not inconsistent with section 104(e)(7) of CERCLA, 42 U.S.C. § 9604(e)(7) or other provisions of law. This claim shall be asserted in the manner described by 40 C.F.R.

§ 2.203(b) and substantiated by Respondents at the time the claim is made. Information determined to be confidential by EPA will be given the protection specified in 40 C.F.R. Part 2. If no such claim accompanies the information when it is submitted to EPA, it may be made available to the public by EPA or the state without further notice to the Respondents. Respondents shall not assert confidentiality claims with respect to any data related to Site conditions, sampling, or monitoring.

82. Respondents shall maintain for the period during which this Amended Order is in effect, an index of documents that Respondents claim contain confidential business information. The index shall contain, for each document, the date, author, addressee, and subject of the document. Upon written request from EPA, Respondents shall submit a copy of the index to EPA.

XXI. RECORD PRESERVATION

83. Respondents shall provide to EPA upon request, copies of all documents and information within their possession and/or control or that of their contractors or agents relating to Operable Unit Two activities at the Site or to the implementation of this Amended Order, including but not limited to sampling, analysis, chain of custody records, manifests, trucking logs, receipts, reports, sample traffic routing, correspondence, or other documents or information related to the Work. Respondents shall also make available to EPA for purposes of investigation, information gathering, or testimony, their employees, agents, or representatives with knowledge of relevant facts concerning the performance of the Work.

84. Until ten (10) years after Work is completed pursuant to this Amended Order, each Respondents shall preserve and retain all records and documents in its possession or control, including the

documents in the possession or control of their contractors and agents on and after the effective date of this Amended Order that relate in any manner to Operable Unit Two. At the conclusion of this document retention period, Respondents shall notify the United States at least ninety (90) calendar days prior to the destruction of any such records or documents, and upon request by the United States, Respondents shall deliver any such records or documents to EPA.

85. Until ten (10) years after Work is completed pursuant to this Amended Order, Respondents shall preserve, and shall instruct their contractors and agents to preserve, all documents, records, and information of whatever kind, nature or description relating to the performance of the Work. Upon the conclusion of this document retention period, Respondents shall notify the United States at least ninety (90) days prior to the destruction of any such records, documents or information, and, upon request of the United States, Respondents shall deliver all such documents, records and information to EPA.

86. Within five (5) days after the effective date of this Amended Order, Respondents shall submit a written certification to EPA's RPM that they have not altered, mutilated, discarded, destroyed or otherwise disposed of any records, documents or other information relating to their potential liability with regard to the Site since notification of potential liability by the United States or the State or the filing of suit against it regarding Operable Unit Two. Respondents shall not dispose of any such documents without prior approval by EPA. Respondents shall, upon EPA's request and at no cost to EPA, deliver the documents or copies of the documents to EPA.

XXII. DELAY IN PERFORMANCE

87. Any delay in performance of this Amended Order that, in EPA's judgment, is not properly justified by Respondents under the terms of this paragraph shall be considered a violation of this Amended Order. Any delay in performance of this Amended Order shall not affect Respondents obligations to fully perform all obligations under the terms and conditions of this Amended Order.

88. Respondents shall notify EPA of any delay or anticipated delay in performing any requirement of this Amended Order. Such notification shall be made by telephone to EPA's RPM or Alternate RPM within forty eight (48) hours after Respondents first knew or should have known that a delay might occur. Respondents shall adopt all reasonable measures to avoid or minimize any such delay. Within five (5) business days after notifying EPA by telephone, Respondents shall provide written notification fully describing the nature of the delay, any justification for delay, any reason why Respondents should not be held strictly accountable for failing to comply with any relevant requirements of this Amended Order, the measures planned and taken to minimize the delay, and a schedule for implementing the measures that will be taken to mitigate the effect of the delay. Increased costs or expenses associated with implementation of the activities called for in this Amended Order is not a justification for any delay in performance.

XXIII. ASSURANCE OF ABILITY TO COMPLETE WORK

89. Respondents shall demonstrate their ability to complete the Work required by this Amended Order and to pay all claims that arise from the performance of the Work by obtaining and presenting to EPA within thirty (30) days after the effective date of this Amended Order, one of the following: (1) a performance bond; (2) a letter of credit; (3) a guarantee by a third party; or (4) internal financial information to allow EPA to determine that Respondents

have sufficient assets available to perform the Work. Respondents shall demonstrate financial assurance in an amount no less than the estimate of cost for the remedial action contained in the Record of Decision for Operable Unit Two. If Respondents seek to demonstrate ability to complete the Work by means of internal financial information, or by guarantee of a third party, they shall re-submit such information annually, on the anniversary of the effective date of this Amended Order. If EPA determines that such financial information is inadequate, Respondents shall, within thirty (30) days after receipt of EPA's notice of determination, obtain and present to EPA for approval one of the other three forms of financial assurance listed above.

90. At least seven (7) days prior to commencing any work at Operable Unit Two pursuant to this Amended Order, Respondents shall submit to EPA a certification that Respondents or their contractors and subcontractors have adequate insurance coverage or have indemnification for liabilities for injuries or damages to persons or property which may result from the activities to be conducted by or on behalf of Respondents pursuant to this Amended Order. Respondents shall ensure that such insurance or indemnification is maintained for the duration of the Work required by this Amended Order.

XXIV. REIMBURSEMENT OF RESPONSE COSTS

91. Respondents shall reimburse EPA, upon written demand, for all response costs incurred by the United States in overseeing Respondents' implementation of the requirements of this Amended Order or in performing any response action which Respondents fail to perform in compliance with this Amended Order. EPA may submit to Respondents on a periodic basis an accounting of all response costs incurred by the United States with respect to this Amended Order. EPA's certified Agency Financial Management System summary

data (SPUR Reports), or such other summary as certified by EPA, shall serve as basis for payment demands.

92. Respondents shall, within thirty (30) days of receipt of each EPA accounting, remit a certified or cashier's check for the amount of those costs. Interest shall accrue from the later of the date that payment of a specified amount is demanded in writing or the date of the expenditure. The interest rate is the rate established by the Department of the Treasury pursuant to 31 U.S.C. § 3717 and 4 C.F.R. § 102.13.

93. Checks shall be made payable to the Hazardous Substances Superfund and shall include the name of the Site, the Site identification number (SSID # 09BE), the account number and the title of this Amended Order. Checks shall be forwarded to:

U.S. Environmental Protection Agency
Region IX
ATTN: Superfund Accounting
P.O. Box 360863M
Pittsburgh, PA 15251

94. Respondents shall send copies of each transmittal letter and check to the EPA's RPM.

XXV. UNITED STATES NOT LIABLE

95. The United States, by issuance of this Amended Order, assumes no liability for any injuries or damages to persons or property resulting from acts or omissions by Respondents, or their directors, officers, employees, agents, representatives, successors, assigns, contractors, or consultants in carrying out any action or activity pursuant to this Amended Order. Neither EPA nor the United States may be deemed to be a party to any contract entered into by Respondents or their directors, officers, employees, agents, successors, assigns, contractors, or consultants

in carrying out any action or activity pursuant to this Amended Order.

XXVI. ENFORCEMENT AND RESERVATIONS

96. EPA reserves the right to bring an action against Respondents under section 107 of CERCLA, 42 U.S.C. § 9607, for recovery of any response costs incurred by the United States related to this Amended Order and not reimbursed by Respondents. This reservation shall include but not be limited to past costs, direct costs, indirect costs, the costs of oversight, the costs of compiling the cost documentation to support oversight cost demand, as well as accrued interest as provided in section 107(a) of CERCLA.

97. Notwithstanding any other provision of this Amended Order, at any time during the response action, EPA may perform its own studies, complete the response action (or any portion of the response action) as provided in CERCLA and the NCP, and seek reimbursement from Respondents for its costs, or seek any other appropriate relief.

98. Nothing in this Amended Order shall preclude EPA from taking any additional enforcement actions, including modification of this Amended Order or issuance of additional orders, and/or additional remedial or removal actions as EPA may deem necessary, or from requiring Respondents in the future to perform additional activities pursuant to CERCLA, 42 U.S.C. § 9606(a), et seq., or any other applicable law. Respondents shall be liable under CERCLA section 107(a), 42 U.S.C. § 9607(a), for the costs of any such additional actions.

99. Notwithstanding any provision of this Amended Order, the United States hereby retains all of its information gathering,

inspection and enforcement authorities and rights under CERCLA, RCRA and any other applicable statutes or regulations.

100. Respondents shall be subject to civil penalties under section 106(b) of CERCLA, 42 U.S.C. § 9606(b), of not more than \$27,500 for each day in which Respondents willfully violate, or fail or refuse to comply with this Amended Order without sufficient cause. In addition, failure to properly provide response action under this Amended Order, or any portion hereof, without sufficient cause, may result in liability under section 107(c)(3) of CERCLA, 42 U.S.C. § 9607(c)(3), for punitive damages in an amount at least equal to, and not more than three times the amount of any costs incurred by the Fund as a result of such failure to take proper action.

101. Nothing in this Amended Order shall constitute or be construed as a release from any claim, cause of action or demand in law or equity against any person for any liability it may have arising out of or relating in any way to the Site.

102. If a court issues an order that invalidates any provision of this Amended Order or finds that any Respondent has sufficient cause not to comply with one or more provisions of this Amended Order, such Respondent shall remain bound to comply with all provisions of this Amended Order not invalidated by the court's order.

XXVII. ADMINISTRATIVE RECORD

103. Upon request by EPA, Respondents must submit to EPA all documents related to the selection of the response action for possible inclusion in the administrative record file.

XXVIII. EFFECTIVE DATE AND COMPUTATION OF TIME

104. This Amended Order shall be effective thirty (30) days after

the Amended Order is signed. All times for performance of ordered activities shall be calculated from this effective date, unless otherwise required by the SOW.

XXIX. OPPORTUNITY TO CONFER

105. Respondents may, within ten (10)) days after the date this Amended Order is signed, request a conference with EPA's Assistant Regional Counsel and Remedial Project Manager to discuss this Amended Order.

106. The purpose and scope of the conference shall be limited to issues involving the implementation of the response actions required by this Amended Order and the extent to which Respondents intend to comply with this Amended Order. This conference is not an evidentiary hearing, and does not constitute a proceeding to challenge this Amended Order. It does not give Respondents a right to seek review of this Amended Order, or to seek resolution of potential liability, and no official stenographic record of the conference will be made. At any conference held pursuant to Respondents' request, Respondents may appear in person or by an attorney or other representative.

107. Requests for a conference must be by telephone followed by written confirmation mailed that day to the Remedial Project Manager.

So Ordered, this 30 day of NOV, 1998.

BY: Keith Takata
Keith Takata
Director, Superfund Division
U.S. Environmental Protection Agency
Region 9

RECORD OF DECISION

OPERABLE UNIT TWO East Phoenix Groundwater Containment

**Motorola 52nd Street Superfund Site
Phoenix, Arizona**



**Motorola 52nd Street Superfund Site
Record of Decision for Operable Unit Two
East Phoenix Groundwater Containment**

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I. DECLARATION

1. Site Name and Location

Motorola 52nd Street
Phoenix, Arizona

2. Statement and Basis of Purpose

This Record of Decision (ROD) presents the interim remedial action the Arizona Department of Environmental Quality (ADEQ) and the United States Environmental Protection Agency (EPA) have selected for Operable Unit Two at the Motorola 52nd Street site in Phoenix, Arizona. This document was developed in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), and, to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). This decision is based on information contained in the Administrative Record for the site.

3. Assessment of the Site

Actual or threatened releases of hazardous substances from this site, if not addressed by implementing the response action selected in this ROD, may present an imminent or substantial endangerment to public health, welfare, or the environment.

4. Description of the Selected Remedy

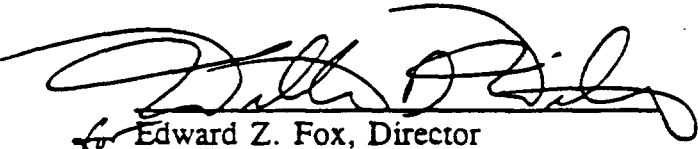
This Record of Decision is for Operable Unit Two at the site, which is an area of contaminated groundwater downgradient of Operable Unit One. In comparing and selecting remedial alternatives for Operable Unit Two, effective and continued operation of Operable Unit One was assumed. The selected remedy is an interim remedy designed to address groundwater that is contaminated with volatile organic compounds (VOCs). The major components of this remedy consist of:

- Extraction of groundwater in the vicinity of Interstate 10 and Van Buren Street.
- Treatment of extracted water near extraction locations by either air stripping with off-gas treatment by synthetic resin adsorption, or advanced oxidation based on final design considerations.
- Injection of treated water back into the aquifer in locations allowing additional control of the contaminant plume.

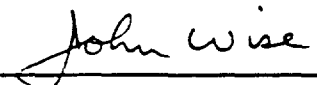
These remedial actions address the principal threat and primary risk at the Motorola 52nd Street site by establishing a capture zone across the entire width and depth of the contaminant plume and by removing and permanently destroying the contaminants from the groundwater. These actions will significantly reduce the toxicity, mobility, and volume of hazardous substances in the groundwater at the site.

5. Statutory Determinations

This interim action is protective of human health and the environment, complies with Federal and State applicable or relevant and appropriate requirements for this limited-scope action, and is cost-effective. Although this interim action is not intended to fully address the statutory mandate for permanence and treatment to the maximum extent practicable, this interim action does utilize treatment and thus is in furtherance of that statutory mandate. Although this action does not constitute a final remedy for the Motorola 52nd Street site, the statutory preference for remedies that employ treatment that reduces toxicity, mobility, or volume as a principal element is satisfied by this remedy. Subsequent actions are planned to address fully the threats posed by the conditions at this site. Because this remedy will result in hazardous substances remaining on site above health-based levels, a review will be conducted within five years after commencement of the remedial action to ensure that the remedy continues to provide adequate protection of human health and the environment. Because this is an interim action ROD, review of this site and of this remedy will be ongoing as ADEQ continues to develop final remedial alternatives for the site.


for Edward Z. Fox, Director
Arizona Department of Environmental Quality

7-1-94
Date


John Wise
Deputy Regional Administrator
USEPA
Region IX

7.21.94
Date

II. DECISION SUMMARY

1. Site Name, Location and Description

The Motorola 52nd Street site is located in Phoenix, Arizona. Activities at this Superfund site began with the investigation of releases of hazardous substances from the Motorola, Inc. Semiconductor Products Plant at 5005 East McDowell Road, in the eastern portion of Phoenix, Arizona, in Maricopa County. Figure 1 shows the location of the Motorola plant within the Phoenix area. Investigations of this facility and investigations under Arizona's Water Quality Assurance Revolving Fund (WQARF) program have identified other potential sources of groundwater contamination. The combined releases from known and suspected sources have created extensive groundwater contamination in the area. Figure 2 shows the current known extent of trichloroethylene (TCE) contamination. As the figure indicates, the western edge of the contaminant plume has not yet been identified, but extends well beyond 7th Avenue. Other contaminants are also present; however, the known areal extent of TCE contamination reasonably encompasses the other contaminants.

The 90-acre Motorola facility is zoned for industrial use and surrounded by a mixture of light industrial and residential properties. The nearest residences are less than 100 feet from the western property boundary. Major geographic features are the Papago Buttes to the east of the plant, the Salt River flowing westerly about one mile to the south, the Old Crosscut Canal located along 46th Street, and the Grand Canal which flows northwesterly through the area west of 40th Street and Van Buren Street. Phoenix Sky Harbor Airport is located approximately 1.5 miles to the southwest. The Papago Military Reservation, a 3/4 square mile facility used by the Arizona National Guard, is located northeast and east of the plant. There are no critical habitats, wetlands, endangered species, or known historic sites in proximity to or affected by the site. This site is not situated in a flood plain.

The Motorola plant lies near the eastern margin of the west basin of the Salt River Valley. The area is underlain by alluvium, but because of the proximity of the plant to the nearby bedrock outcrops at the Papago Buttes, bedrock occurs at a relatively shallow depth. In monitor wells at the east boundary, bedrock was encountered at a depth of 20 to 30 feet below the ground. The thickness of the alluvium increases to the west. On the western boundary of the plant, the thickness of alluvium is greater than 60 feet at some locations. Farther to the west, the thickness of the alluvium continues to increase. At the Old Crosscut Canal, the alluvium is approximately 80 to 90 feet thick, and at a monitor well on 36th Street, about 2 miles west of the plant, the thickness of the alluvium is more than 200 feet.

The direction of regional groundwater flow, both in the alluvium and the bedrock, in the vicinity of the Motorola plant is predominantly from the northeast to the southwest, although local variations in this overall pattern are present. This pattern was not found to vary significantly during the course of the initial Remedial Investigation/Feasibility Study (RI/FS). From the mid-1950's until 1980, the direction of groundwater flow west of the plant may have had a more northerly component than it has had in more recent years.

The Motorola facility is paved and consists of several large buildings used for the production

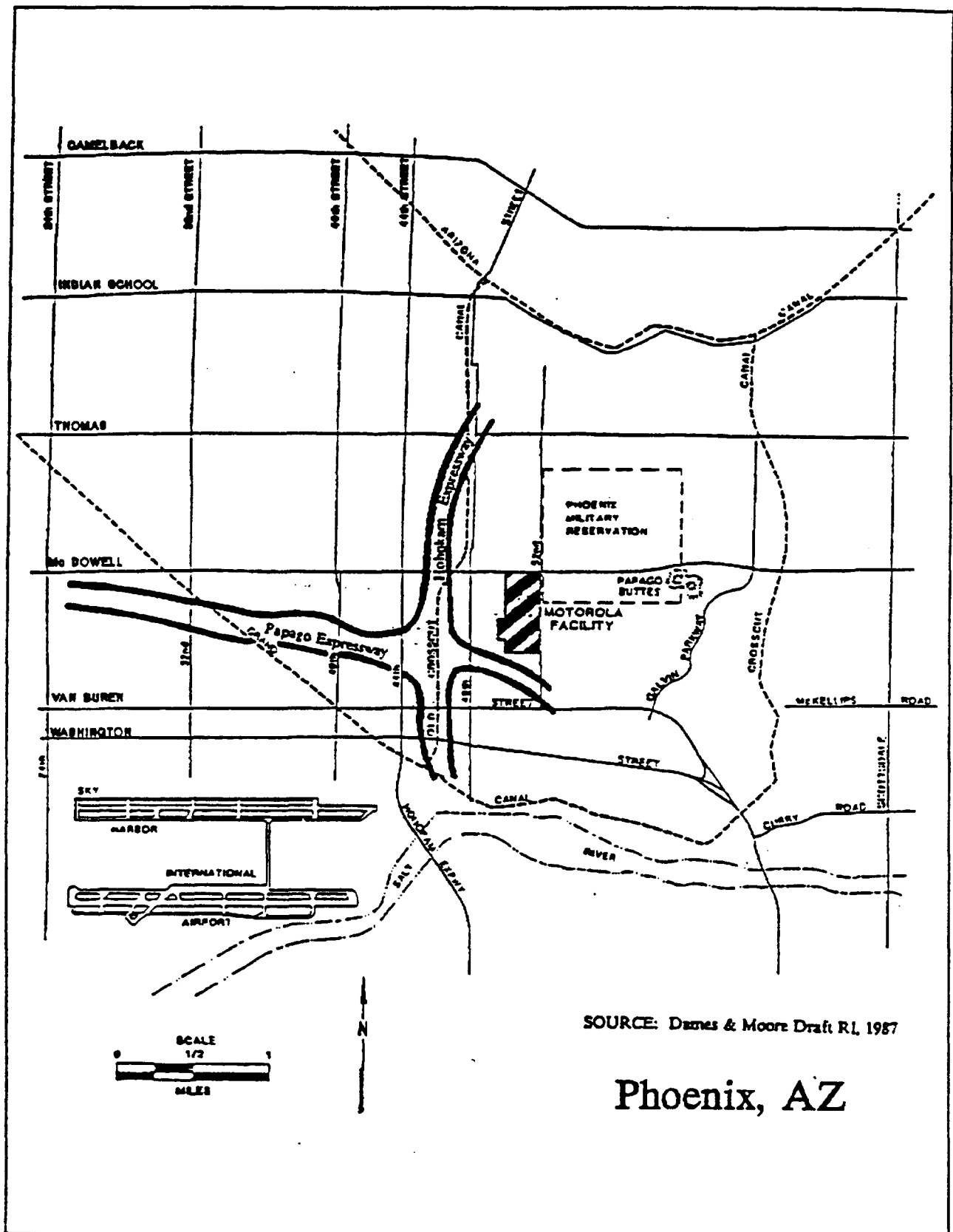
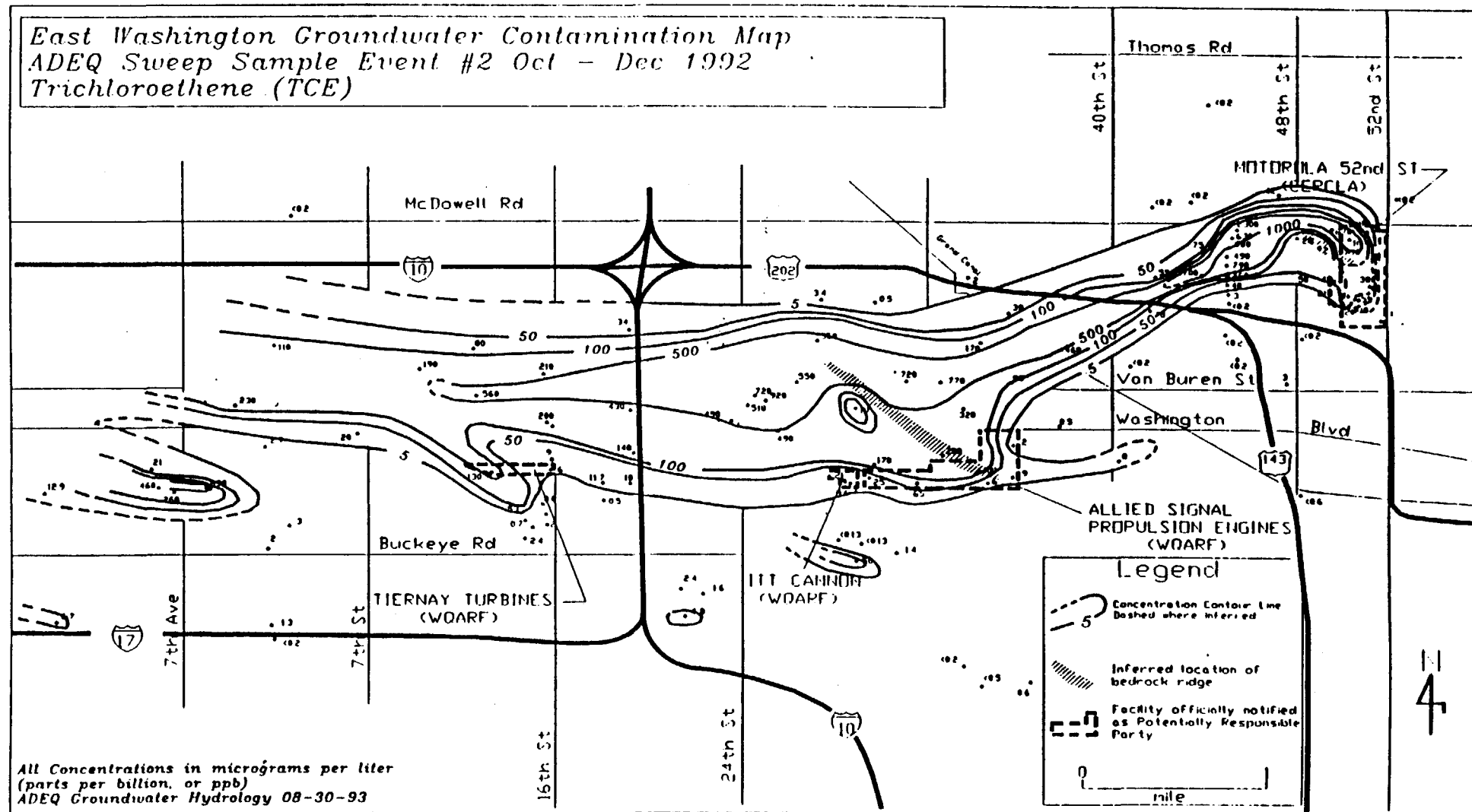


Figure 1. Site Vicinity Map

Figure 2. Current extent of TCE contamination in groundwater



of semiconductors, for the storage of product and chemicals, and for administrative purposes. The facility also contains a reverse-osmosis/deionization plant that produces ultra-clean water for the manufacturing process, cooling towers for the facility, and large parking areas for employees. The soil vapor extraction equipment and the Integrated Groundwater Treatment Plant for treatment of extracted groundwater, constructed as part of the remedy for Operable Unit One, are also on the facility property. Figure 3 shows major buildings and features.

2. Site History and Enforcement Activities

The Motorola 52nd Street facility was originally constructed in 1956. Prior to that time, the location was largely agricultural. In 1982, Motorola discovered a solvent leak at an underground storage tank. Motorola notified the Arizona Department Of Health Services (ADHS) and initiated a Preliminary Investigation for potential soil and groundwater contamination. The report of the Preliminary Investigation, which was published on December 9, 1983, indicated soil and groundwater contamination at the plant and groundwater contamination to the west of the plant. As a result of these findings, Motorola entered into a oral agreement with EPA, ADHS and the Arizona Department of Water Resources (ADWR) to characterize the environment near the plant, identify the nature and extent of contamination and recommend remedial actions. Potential sources of contamination include past surface discharges, spills, tank and pipe leaks, and discharges to leach fields and dry wells.

Based on conservative assumptions, it is estimated that Motorola disposed of approximately 200,000 gallons of chlorinated solvents at the plant between the late 1950s and 1983. It is estimated that TCE was disposed of in the greatest quantity (116,000 gallons), followed by trichlorotrifluoromethane (57,000 gallons), and xylenes (26,000 gallons). The amount of trichloroethane (TCA) which Motorola disposed or leaked is estimated at approximately 8,000 gallons. Some toluene and tetrachloroethylene (PCE) were also disposed at the plant.

ADEQ accepted Motorola's Remedial Action Plan for Operable Unit One in a Letter of Determination on September 27, 1988. EPA's concurrence with that Letter of Determination was formalized in a Record of Decision signed on September 30, 1988. A Consent Decree was executed in July 1989 between ADEQ and Motorola for the design and implementation of the remedy for Operable Unit One. The Consent Decree also committed Motorola to additional remedial investigation and feasibility study work.

Operable Unit One (OU1) addresses organic solvents in soils and alluvium groundwater. The facilities for containment of on-plant and near-plant groundwater contamination have been in operation since May 1992. The on-plant soil vapor extraction (SVE) treatment system has been in operation since April 1992.

Three companies other than Motorola received General Notice letters in late 1992 notifying them of their potential liability at the site. These companies are AlliedSignal Corporation, ITT Cannon, and Tiernay Turbines. The City of Phoenix also received General Notice as the property owner for the AlliedSignal and ITT Cannon facilities. The locations of these facilities can be seen in Figure 2. These facilities were determined to be potentially responsible parties (PRPs) for the groundwater contamination as a result of investigations conducted under the State of Arizona's Water Quality Assurance Revolving Fund (WQARF) program.

SOURCE: Demas & Moore Draft R1, 1987

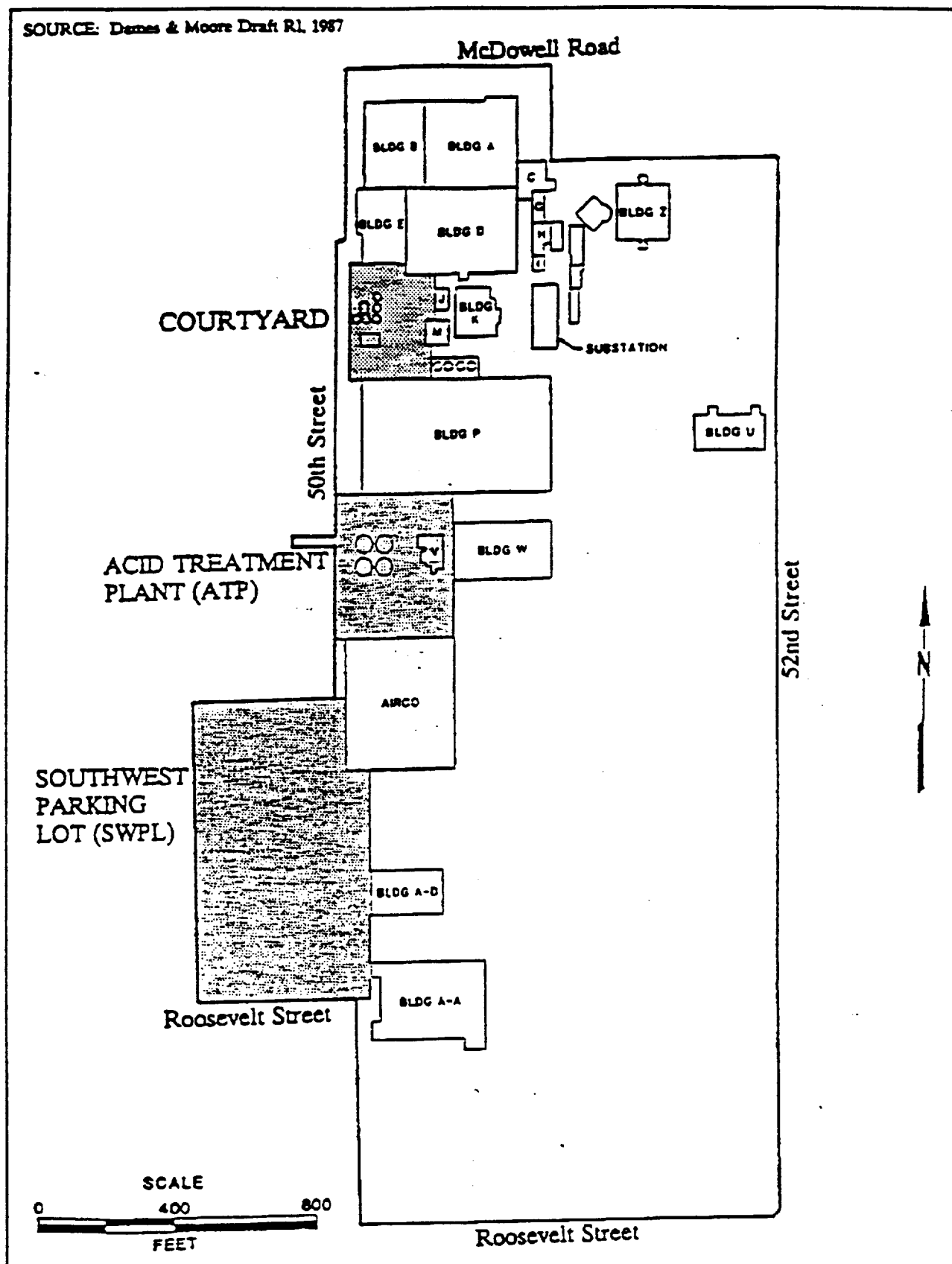


Figure 3. Motorola 52nd Street Facility Map

Volatile organic compounds (VOCs) in concentrations exceeding drinking water standards (also referred to as Maximum Contaminant Levels, or MCLs) have been detected in groundwater as far southwest as 75th Avenue and Van Buren Street. A coordinated "area sweep" groundwater quality sampling event that included the Motorola wells and wells in the East Washington WQARF investigation area took place in April, May and June, 1992. A second sweep was conducted during November and December 1992. TCE contamination has been identified by ADEQ as shown in Figure 2. The contamination extends beyond the East Washington area and into the West Van Buren WQARF area, to approximately 75th Avenue. Figure 4 shows the location of groundwater contamination projects near the Motorola 52nd Street site. In Spring of 1993, ADEQ and EPA decided to develop a second operable unit instead of a final remedy because of the extent of groundwater contamination.

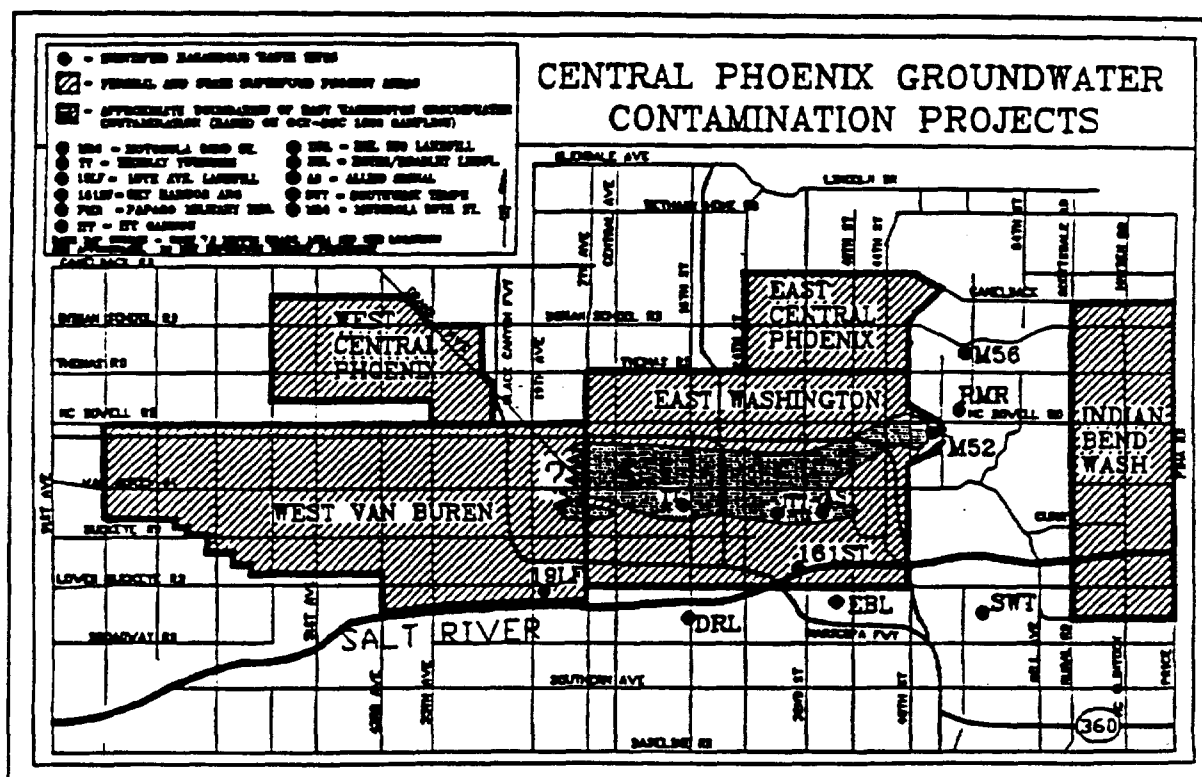


Figure 4. Area Groundwater Contamination Projects

Motorola conducted on-plant and off-plant soil gas testing in 1984 and 1985. ADEQ conducted soil gas testing in a residential area west of the Motorola 52nd Street facility in March 1992. The Arizona Department of Health Service's (ADHS) interpretation of the soil gas data concluded that the level of volatile organics in the soil gas does not present a current risk to human health. Additional soil gas sampling was done in July 1992, and results were consistent with the previous sampling data.

A Baseline Risk Assessment was completed by ADHS in November 1992. Groundwater and soil gas data were used in the assessment. Section 6 of this Record of Decision describes the risk assessment in more detail.

In October/November 1990, TCA was detected at 5100 parts per billion (ppb) in monitor well DM 201 in the Southwest Parking Lot (SWPL) area of the Motorola 52nd Street plant. Further studies, including soil gas testing and soil and groundwater investigations, revealed a separate source of contamination from the sump of the Chemix room of Building A-D. Concentrations of both TCA and 1,1 dichloroethene (DCE) in the groundwater and soil gas increased significantly in the SWPL area during the period from 1989 to 1991. Groundwater contamination extends at least 150 feet from the plant to the southwest of the parking lot, but has not been detected at well DM 733, located approximately 600 feet downgradient of the parking lot. Groundwater contamination from the SWPL area is not currently believed to merge with the larger contaminant plume. There are over 24 on-plant and off-plant wells in the SWPL monitor well network. Extraction wells have been installed along the south boundary of the parking lot. The purpose is to create a capture zone sufficient to prevent further off site migration of contaminated groundwater. Water pumped from this area is treated at the currently operating OU1 groundwater treatment plant on the Motorola plant. Wells continue to be installed to identify the extent of contamination in this area. Ongoing remedial actions in the SWPL area will be considered during development of final remedy alternatives for the Motorola 52nd Street Superfund site.

3. Community Participation

After construction of the treatment facilities for Operable Unit One, ADEQ conducted a variety of community involvement and education activities. In March 1992, when ADEQ was conducting soil gas investigations, a fact sheet was distributed to describe activities occurring at the site. During the summer of 1992, another fact sheet was distributed after the soil gas data had been evaluated by the Arizona Department of Health Services. A fact sheet was distributed during the summer of 1993 after ADEQ compiled data from this project and the East Washington Water Quality Assurance Revolving Fund project and created a series of contour maps (similar to Figure 2) outlining the immense area of apparently continuous groundwater contamination.

During most of 1992, ADEQ met regularly with a citizens' committee to discuss current activities and clarify technical issues. The meetings were held generally once a month, although the first few were more frequent. A variety of issues were discussed during these meetings, including soil gas, risk assessments, private wells, drinking water, and data requirements.

An informational meeting was held in December 1991 to discuss a variety of issues with the community. In July 1993, ADEQ held a series of open houses at several locations within the site to explain the recently-completed contaminant contour maps.

The Gateway Neighborhood Coalition has received a Technical Assistance Grant from the EPA. The grant has allowed the group to hire a technical advisor to help them understand the technical issues about the site. The technical advisor is attending meetings held by ADEQ with potentially responsible parties.

The public comment period for the Remedial Investigation/ Feasibility Study and Proposed Plan for Operable Unit Two was announced January 5, 1994 by notice in the Arizona Republic newspaper. The comment period was to extend to February 4, 1994. A timely request from

the Gateway Neighborhood Coalition caused ADEQ to extend the comment period until March 7, 1994. Notice in the Arizona Republic newspaper on February 4, 1994 and a brief fact sheet announced the extension of the comment period. Due to combined requests from Potentially Responsible Parties and the Gateway Neighborhood Coalition on February 25, 1994, the public comment period was extended a second time to April 6, 1994. Notice of this extension appeared in the Arizona Republic newspaper on March 9, 1994. Two availability sessions (Open House style meetings) were held on January 25 and 27, 1994. The public meeting to take oral and written comments was held on February 3, 1994. A response to comments received during the public comment period is included in the attached Responsiveness Summary prepared by ADEQ.

4. Scope and Role of Operable Unit Two

This is the second operable unit (OU) initiated by ADEQ to date. As part of the remedy for OU1 selected in the 1988 ROD, Motorola has begun clean-up of groundwater near the 52nd Street plant to reduce the risk from and migration of the contamination. This second OU addresses groundwater contamination in eastern Phoenix in the area west of the Old Crosscut Canal and east of Interstate 10. The available data indicate the presence of groundwater contamination in this area at levels well above drinking water standards and are sufficient to determine the approximate size and location of the needed action. ADEQ is confident the selected remedy for this OU represents a significant step toward cleanup of the area and will not be inconsistent with, or preclude implementation of, a final remedy. ADEQ has not yet selected a final remedy for the Motorola 52nd Street site, but the final remedy is expected to include, at a minimum, limiting contaminant migration in this and other highly contaminated areas of the site.

OU2 is classified as an interim action to reflect the possibility that additional remedial actions in this area may be needed. ADEQ will use information collected during operation of the selected remedy to help determine the need for additional actions and the nature of the final remedy.

The primary purpose of this response action is to establish a capture zone across the entire width and depth of the contaminant plume in the area of Interstate 10. A secondary purpose is to reduce contaminant concentrations within the alluvial aquifer upgradient of the extraction wells. Also, additional hydrogeologic data collected during this interim action will facilitate development of additional remedies. This ROD establishes additional interim measures to control the contamination. Groundwater will be extracted and treated to a level at or below Maximum Contaminant Levels (MCLs). ReInjection of the treated water will enhance hydraulic control of the plume. This interim action will be consistent with future actions, to the extent practicable.

5. Site Characteristics

The Motorola 52nd Street site contamination consists primarily of VOCs including TCE, tetrachloroethylene (PCE), trichloroethane (TCA), and associated degradation products, including vinyl chloride. Arsenic and fluoride also occur above background levels west of the Motorola plant. This area of contamination is not currently used as a source of drinking water; however, the area could potentially be used as a drinking water source.

Levels of contamination beneath the Motorola facility have been detected as high as 4,000,000 ppb of TCE. The presence of non-aqueous phase (pure product) liquids has been detected in wells on the Motorola plant. Operable Unit One is intended to contain these high levels of contaminant east of the Old Crosscut Canal at 46th Street. However, an apparently continuous area of groundwater contamination extends west-southwest to 7th Avenue and beyond (see Figure 2). The western boundary of the contaminant plume lies within the West Van Buren WQARF area and has not yet been identified. Potential releases at AlliedSignal, ITT Cannon, and Tiernay Turbines, as well as other facilities, may also be contributing to the groundwater contaminant plume that begins at the Motorola plant at 52nd Street.

The contaminants of potential concern for this operable unit are those hazardous substances that demonstrate toxic effects to human health and the environment, persist at levels above the health-based standards, and are consistently detected. The contaminants of potential concern are TCE, PCE, TCA, and their associated degradation products including vinyl chloride. Fluoride and arsenic exist near the plant above background levels, however these will not be addressed as part of this interim remedy. Inorganic contaminants will be addressed as part of the final remedy for the site. The contaminants of potential concern for this operable unit are known or suspected human carcinogens.

6. Summary of Site Risks

The Arizona Department of Health Services (ADHS) prepared a Baseline Risk Assessment for the Motorola 52nd Street Facility in November 1992. This Risk Assessment characterized the current and potential threats to human health assuming no action were taken to remediate the contamination. The Risk Assessment analyzed potential threats from contaminants in the groundwater, contaminants in the soils, and contaminants released from the soils. For the groundwater risk calculations, ADHS used comprehensive organic priority pollutant and inorganic chemical data from groundwater samples taken from 54 monitoring wells in alluvium and/or bedrock. Analyses of groundwater samples from soil borings which encountered groundwater were included where possible. The Risk Assessment does not include evaluation of data from wells installed and sampled since early 1992. Figure 5 shows the area studied in the Risk Assessment, and the monitor wells used.

Contaminants of potential concern

The Baseline Risk Assessment identified the compounds in Table 1 as chemicals of potential concern for the Motorola 52nd Street site, based upon review of water quality analyses from the wells. Chemicals were placed on the list if they were detected at levels greater than background levels; were considered a potential threat to human health; were detected in at least one monitor well; and the highest level detected exceeded MCLs or Health-Based Guidance Levels (HBGLs), or the chemical is a possible, probable or suspected human carcinogen.

The selected chemicals were designated "chemicals of potential concern" and were included in the computation of health risk.

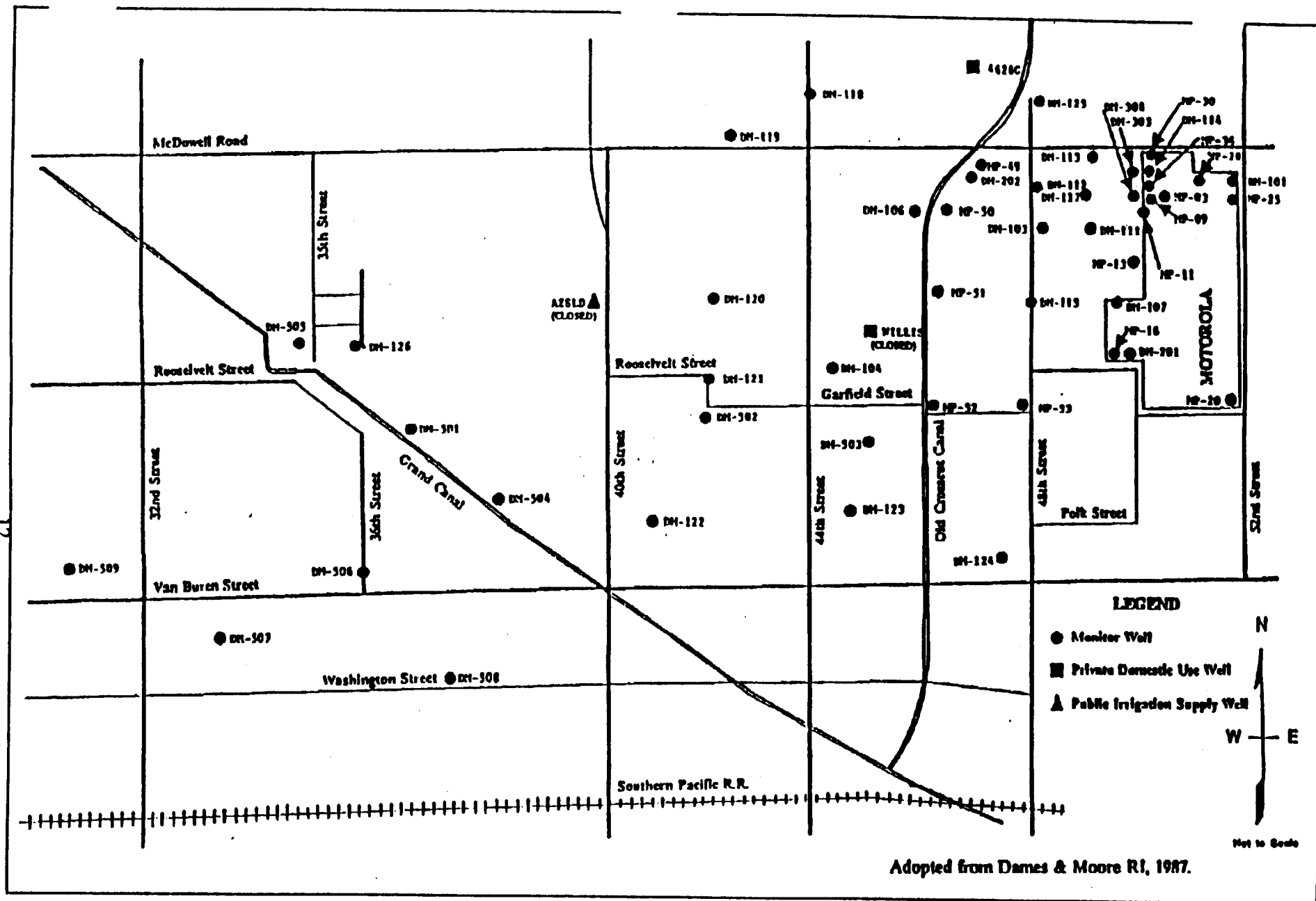


Figure 5. Well Boring and Sample Locations used in the 1992 Risk Assessment

Table 1. Chemicals of Potential Concern, and range of concentrations detected

Chemical	Min. Detected	Max. Detected
INORGANIC CHEMICALS (reported in parts per million)		
Arsenic	0.005	2.6
Boron	0.14	7.5
Cadmium	0.005	0.024
Chromium (VI)	0.07	0.15
Chromium (total)	0.01	0.24
Cyanide	0.01	0.21
Fluoride	0.2	25
Lead	0.002	0.08
Manganese	0.01	8.13
Nickel	0.02	0.22
Nitrate	0.37	92
Silver	0.1	0.1
Sulfate	9	3400
Thallium	0.0009	0.014
Zinc	0.01	2
ORGANIC CHEMICALS (reported in parts per billion)		
Benzene	2.3	2.3
Bromodichloromethane	0.26	314
Carbon Tetrachloride	0.3	0.6
Chlorobenzene	0.3	1300
Chloroform	0.2	1500
Chloromethane	2.1	14
Dibromochloromethane	0.2	1.1
1,2-Dichlorobenzene	0.88	5600
1,1-Dichloroethane	0.09	1300
1,2-Dichloroethane	0.2	1500
1,4-Dichlorobenzene	36.9	36.9
1,2 & 1,4-Dichlorobenzene	0.2	65000
1,1-Dichloroethylene	0.3	26600
1,2-Dichloroethylene	0.2	7000
Dichloromethane	2.7	170000
trans-1,3-Dichloropropene	17.9	17.9
Tetrachloroethylene	0.2	30000
1,1,1-Trichloroethane	0.2	330000
1,1,2-Trichloroethane	4	4
Trichloroethylene	0.2	4100000
Vinyl Chloride	1.4	20000

A review of water quality data from wells that were included in the January 1993 Quarterly Report prepared by Motorola shows no additional compounds above MCLs or HBGLs in the expanded well area.

Exposure Assessment

The second step of the Risk Assessment identified possible exposure pathways. An exposure pathway is considered complete when a chemical of concern contacts a receptor (person). In the Baseline Risk Assessment for the Motorola 52nd Street site, potentially exposed populations are residents living near the facility and workers at the facility. ADHS determined that the possible exposure pathways include ingestion, inhalation, and dermal contact with contaminated groundwater, and inhalation of vapors from soils.

Currently, there are no private or public drinking water wells supplying drinking water from the known area of groundwater contamination. One private well northwest of the facility, 4626G, has been used for filling a swimming pool and residential irrigation. Well 4626G was also reportedly used for indoor domestic use for approximately six months during 1989 to 1990. One irrigation well, SRP well 18E-5N, periodically supplements water in the Grand Canal with groundwater from the area. Groundwater quality data for 54 wells sampled throughout the area between 1988 and 1991 were used to calculate potential exposure concentrations from groundwater. Table 1 shows the range of concentrations detected in wells tested during this period for the chemicals of potential concern.

Vadose zone remediation is not a goal of this interim action, and therefore exposures to contaminated soils or soil gas are not addressed in detail in this summary of site risks. Potential exposure to soil gas vapors was calculated for three groups: on-site outdoor workers; on-site indoor workers; and area residents. The potential for health effects to nearby residents through exposure to soils or soil vapors was determined to be insignificant.

The Risk Assessment calculated the average and the reasonable maximum exposures by ingestion or inhalation of the contaminants. Major exposure assumptions are summarized in Table 2.

Toxicity Assessment

The next step of the Risk Assessment was to determine the carcinogenic and non-carcinogenic toxicity of the contaminants of potential concern. Risk was calculated differently for carcinogenic and non-carcinogenic risks.

Carcinogenic Effects

EPA's Carcinogenic Assessment Group developed cancer potency factors (CPFs), also called Slope Factors, to estimate excess lifetime cancer risks associated with exposure to potentially carcinogenic chemicals. Slope Factors (SF), which are expressed in units of (mg/kg-day)⁻¹, are multiplied by the estimated intake of a potential carcinogen, in mg/kg-day, to provide an upper-bound estimate of the excess lifetime cancer risk associated with exposure at that intake level. The term "upper bound" reflects the conservative estimate of the risks calculated from the SF. Use of this approach makes under-estimation of the actual cancer risk highly unlikely.

Table 2. Major Exposure Assumptions in Risk Calculations

Exposure Factors		
parameter	Intake value (adult)	
	average	reasonable maximum
Body Weight	70 kilograms	70 kilograms
Years in lifetime*	70 years	70 years
Ingestion rate (water)	2 liters/day	2 liters/day
Inhalation rate (air)	20 cubic meters/day	20 cubic meters/day
Groundwater		
Exposure frequency	350 days/year	350 days/year
Exposure duration*	9 years	30 years
Occupational air (indoor and outdoor)		
Exposure time	4 hours/day	8 hours/day
Exposure frequency	250 days/year	250 days/year
Exposure duration*	9 years	30 years
Residential Air (outdoor)		
Exposure time	2 hours/day	8 hours/day
Exposure frequency	350 days/year	350 days/year
Exposure duration*	9 years	30 years
Residential Air (indoor)		
Exposure time	16 hours/day	24 hours/day
Exposure frequency	350 days/year	350 days/year
Exposure duration*	9 years	30 years

* Carcinogenic effects are averaged over a 70 year lifetime, while non-carcinogenic effects are averaged over the exposure duration listed in the table.

Cancer potency factors are derived from the results of human epidemiological studies or chronic animal bioassays to which animal-to-human extrapolation and uncertainty factors have been applied.

Slope factors were obtained from EPA's on-line Integrated Risk Information System (IRIS) and Health Effects Assessment Summary Tables databases.

Non-Carcinogenic Effects

EPA developed reference doses (RfDs) for indicating the potential for adverse health effects from exposure to chemicals exhibiting noncarcinogenic effects. RfDs, which are expressed in units of mg/kg-day, are estimates of lifetime daily exposure levels for humans, including sensitive individuals, who are likely to be without an appreciable risk of deleterious effects during a lifetime. Estimated intakes of chemicals from environmental media (e.g., the amount of a chemical ingested from contaminated drinking water) can be compared to the RfD. RfDs are derived from human epidemiological studies or animal studies to which uncertainty factors have been applied (e.g., to account for the use of animal data to predict effects on humans).

Risk Characterization

Risks, both current and potential, are characterized and evaluated utilizing exposure and toxicology information. Risk characterization is presented in both quantitative and/or qualitative format. When data are available, quantitative risk characterizations are performed and evaluated qualitatively. Risk estimation methods used in the risk assessment proceed from estimation for a single compound and exposure route, to a summation of risk for all chemicals of concern for a given route, and culminating with a summation of risk across exposure routes.

Carcinogenic risk is calculated as the incremental probability of an individual developing cancer over a lifetime (70 years) due to exposure to a carcinogenic compound. This is also referred to as incremental or excess lifetime cancer risk (ELCR) and represents the increased risk of developing cancer above the background rate, estimated at about 3×10^{-1} (30%). Non-carcinogenic effects include neurotoxic, hepatotoxic, nephrotoxic, teratogenic, and reproductive reactions, and any other noncancer related systemic toxic responses. The potential for an individual suffering a noncarcinogenic effect is not expressed as a probability, but as a ratio or quotient. The hazard index is the ratio of an exposure level over a specified period (CDI) to the chemical specific reference dose (RfD) which is not expected to produce toxic effects over the period of concern.

A well-by-well approach was taken due to the large area covered by the monitor wells and the large differences in concentrations of chemicals over that area. The potential ingestion risk, cancer hazard index, and systemic hazard index were calculated for each chemical of concern, on a well-by-well basis. A well total for each category was determined by summing the entries. Table 3 presents the range of calculated potential ELCR and non-cancer hazard indices under average and reasonable maximum exposures.

Table 3. Range of calculated potential ELCR and non-cancer hazard indices under average and reasonable maximum exposures

	<u>Average Exposure</u>		<u>Reasonable max. exposure</u>	
	minimum	maximum	minimum	maximum
ELCR	8×10^{-7} (well DM123)	1×10^{-2} (wells DM117 & MP11)	3×10^{-6} (well DM123)	7×10^{-2} (well MP03)
Hazard Index	2.9×10^{-3} (well DM123)	3.7×10^{-2} (well MP03)	2.9×10^{-3} (well DM123)	8.2×10^{-2} (well MP03)

The Baseline Risk Assessment for this site demonstrates that potential risk from exposure to contaminated groundwater is greater than the 1×10^{-4} , or one-in-ten-thousand, upper limit of the generally acceptable risk range specified in the National Contingency Plan. This is true for areas upgradient and downgradient of the current containment line of Operable Unit One. Therefore, additional groundwater remedies are necessary at this site.

Environmental Risk

An Ecological Risk Assessment performed by EPA in April 1993 concludes that no threatened or endangered species have been verified in the vicinity of the Motorola 52nd Street facility. Two wells used for irrigation, domestic well 4626G and Salt River Project (SRP) well 18E-5N, may potentially expose plants and animals to contaminants in groundwater. The average concentration of TCE detected in well 4626G is 0.3 ppb, with the highest detection being 0.7 ppb. Water from the SRP well is diluted as it is discharged into the canal system by a factor of 59 in the winter and 294 during the summer. VOCs have not been detected in this well.

Groundwater may also be encountered in the Old Crosscut Canal at approximately Oak Street, where a spring seep occurs. Model predictions estimate contaminant concentrations in groundwater at this point to be approximately 10 ppb of VOCs, which would be diluted due to flows in the canal.

Summary

All risk estimates in the Risk Assessment were based on a number of assumptions regarding contaminant concentrations and fate, exposures, doses, and toxicity information. ADHS took care at each step to ensure that assumptions and estimates were representative of upper bounds. True risk may be much less than calculated. This was done purposely to be protective of public health.

The conclusion of the Risk Assessment and the Remedial Investigation/Feasibility Study is that releases of hazardous substances from this site present an imminent and substantial endangerment to public health, welfare, and the environment in the absence of any remedial action. Response

action to date has reduced site risk, but groundwater contamination at the site still exceeds Maximum Contaminant Levels and warrants additional remedial action.

7. Description of Alternatives

The specific objectives for the interim remedial action in Operable Unit Two are to establish a capture zone across the entire width and depth of the contaminant plume, and to begin to remove contaminants from the groundwater for eventual restoration of the aquifer as a potential source of drinking water. The remedy for OU2 is an interim action. Accordingly, the remedy does not include aquifer remediation standards or a restoration timeframe. A final remedy for the entire Motorola 52nd Street site will be developed after further investigation to define the extent of groundwater contamination.

The Interim Remedy Feasibility Study (IRFS) for Operable Unit Two, and the supplement to the IRFS, evaluated seven alternatives. These alternatives are briefly described below. The alternatives are further briefly explained in the "Proposed Plan for the Motorola 52nd Street Superfund Site" completed by ADEQ in January 1994.

No Action Alternative

The Superfund program requires that a "No Action" alternative be evaluated at every site as a baseline for comparison of other cleanup alternatives. Under this alternative, no further action (beyond continued operation of the existing OU1 containment system) would be taken to limit migration of contaminated groundwater. Five additional monitoring wells would be installed to define and monitor the extent of groundwater contamination downgradient of OU1. The monitoring program would include water level measurements and analysis of water samples on a quarterly basis.

Costs associated with the No Action alternative are considered base costs and thus no comparison is made with other alternatives.

Alternatives 11, 11C, 21, 64R, and 64C

The numbers describing the alternatives in this Record of Decision are consistent with those used in the Interim Remedy Feasibility Study, the IRFS supplement, and the Proposed Plan to allow easy reference to those documents. Charts describing these alternatives appear underneath Figure 6 and in Table 4.

The five alternatives described below all include groundwater extraction, treatment of extracted water, disposal of treated water via a beneficial end use, and the installation of additional monitoring wells. Each of the alternatives was developed and evaluated assuming continued operation of the existing OU1 groundwater containment system. Treatment of the extracted groundwater for removal of VOCs will be accomplished using either air stripping (with treatment of air emissions and off-site incineration of recovered solvents) or advanced oxidation (which uses ultraviolet light to destroy VOCs). These two technologies are discussed in detail in the IRFS. Both are considered to be established, reliable technologies for removal of the VOCs of

concern at this site. Depending on location of the treatment plant, each has advantages over the other. Selection of the preferred technology will therefore be made during remedial design. For the purpose of calculating the costs of each alternative, it was assumed that air stripping would be the selected technology for VOC removal.

The differences between the alternatives are mainly 1) the location where groundwater extraction would take place and 2) what the beneficial use of the treated water would be. The amount of contaminants removed over time also differs between alternatives. A computer model was used to determine the pumping rates that would result in effective capture of the plume at each alternative location. Figure 6 shows the general location of the line of extraction wells for each of the alternatives and the resulting capture zone.

The IRFS also includes a detailed description and evaluation of alternative 64, in which groundwater would be extracted near Interstate 10, treated for VOCs and discharged to an existing stormwater drain leading to the Salt River. This discharge option was subsequently determined to be inconsistent with the requirement for beneficial end use, and the alternative was eliminated from further consideration.

Alternative 11 - Extraction at the Grand Canal, treatment for VOCs and Fluoride, and ReInjection

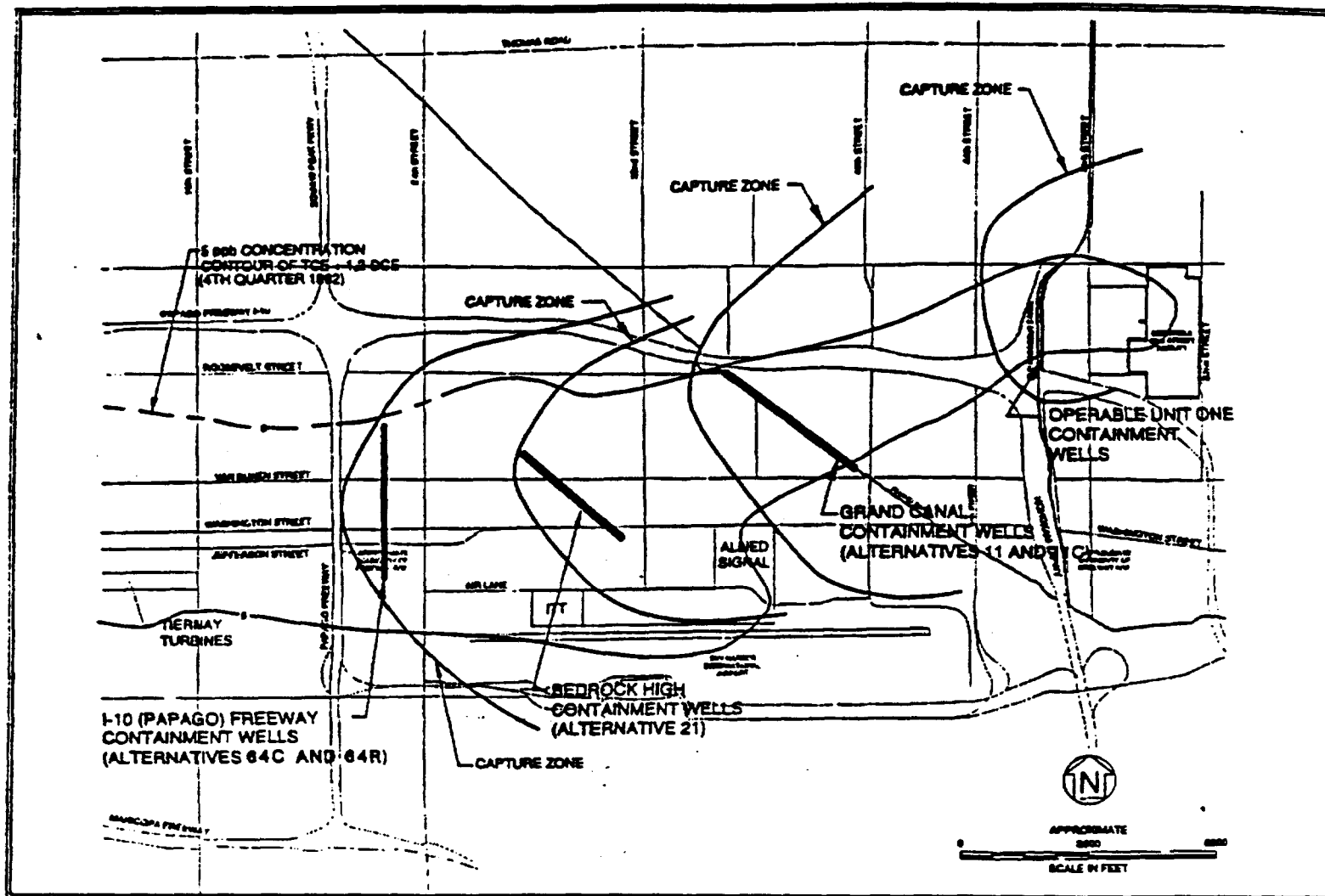
This alternative would provide containment of contaminated groundwater in the area of the Grand Canal. Extraction wells would be located along the east side of the Grand Canal and injection wells would be located east of the Grand Canal. Some injection wells would be located along the north and south edges of the plume to keep contaminants from moving in those directions, and others would be located in the central portion of the plume.

Groundwater would be extracted at a rate of approximately 2800 gallons per minute and treated for VOCs and fluoride to meet drinking water standards. Fluoride would be removed from the water using activated alumina adsorption, in order to meet treatment standards for reinjection. The calcium fluoride sludge generated by the activated alumina process would be disposed of in a landfill.

The capture zone would contain approximately 0.7 additional square miles of the contaminant plume beyond OU1. The treatment system would remove approximately 800 gallons of TCE from the aquifer over a 20 year period. (Gallons of TCE removed is supplied for comparison purposes. Other VOCs would also be removed.) The capture zone (see Figure 5) will be achieved within one year of system start-up.

Capital costs for this alternative are estimated to be \$11,950,000 and annual operation and maintenance (O&M) costs are \$2,450,000. The present value is calculated to be \$40,000,000. A large part of this cost is associated with the fluoride treatment technology (approximately 25% of capital costs and 45% of annual O&M costs).

Figure 6. Alternative containment lines and features



	NO ACTION	ALTERNATIVE 11 Extraction at Grand Canal, reinjection	ALTERNATIVE 11C Extraction at Grand Canal, discharge to Grand Canal	ALTERNATIVE 21 Extraction at Bedrock High, reinjection	ALTERNATIVE 64C Extraction at Papago Freeway, discharge to Grand Canal	ALTERNATIVE 64R Extraction at Papago Freeway, reinjection
Estimated No. of New Wells	5 - monitoring ¹	4 - extraction 12 - injection 7 - monitoring	4 - extraction 7 - monitoring	8 - extraction 9 - injection 7 - monitoring	2 - extraction 8 - monitoring	2 - extraction 15 - injection 8 - monitoring
Treatment Capacity	no additional capacity	2800 gallons per minute	2800 gallons per minute	1900 gallons per minute	4000 gallons per minute	4000 gallons per minute
Overall Protectiveness	No additional containment	0.7 square mile containment area	0.7 square mile containment area	1.5 square mile containment area	2.6 square mile containment area	2.6 square mile containment area
Contaminants Treated		VOCs and fluoride	VOCs	VOCs	VOCs	VOCs
Reduction of Toxicity, Mobility, or Volume through Treatment	250 gallons of TCE removed by OU1 in 20 years	800 gallons of TCE removed in 20 years	850 gallons of TCE removed in 20 years	1350 gallons of TCE removed in 20 years	2250 gallons of TCE removed in 20 years	2000 gallons of TCE removed in 20 years
1-year cost (present value)	base costs ²	\$40,000,000 ³	\$19,000,000	\$21,000,000	\$28,000,000	\$31,000,000

¹ Number of monitor wells for No Action are part of, not in addition to, those listed for the remaining alternatives.

² Elements of the No Action Alternative are constant for all alternatives, other costs listed are above and beyond these costs.

³ Treatment of fluoride in Alternative 11 is a large portion of the cost.

Alternative 11C - Extraction at Grand Canal, Treatment for VOCs, and Discharge to the Grand Canal

This alternative is similar to Alternative 11. Extracted water would be treated for VOCs only, and the treated water would be discharged into the Grand Canal for irrigation use instead of being injected back into the ground. No treatment for fluoride would be conducted because fluoride concentrations in extracted groundwater would not exceed standards applicable to irrigation water.

The capture zone would contain approximately 0.7 additional square miles of the contaminant plume, and remove approximately 850 gallons of TCE from the aquifer over a 20 year period. (Gallons of TCE removed is supplied for comparison purposes. Other VOCs would be also be removed.) The capture zone (see Figure 6) will be achieved within one year of system start-up. For approximately one month every year, discharge to the Grand Canal will not be allowed while the canal is drained for maintenance. During this period, containment, primarily along the peripheries of the capture zone, will be lost. If the effects of the one-month shutdown on maintaining containment are unacceptable, alternatives (such as reinjection) are available to allow the extraction system to continue to operate. However, the additional costs of such discharge alternatives are not included in the cost figures described below.

Capital costs for this alternative are estimated to be \$3,780,000 and annual operation and maintenance costs are \$1,260,000. The present value is calculated to be \$19,000,000.

Alternative 21 - Extraction at the Bedrock High, Treatment for VOCs, and Reinjection

An area of elevated bedrock, referred to in the Interim Remedy Feasibility Study as a Bedrock High, exists oriented southeast to northwest near 32nd Street and Washington. The location is near the proposed location of extraction wells seen in Figure 6. This alternative is designed to make use of this geologic feature to aid the containment of the contaminants. Groundwater extraction would occur near the Bedrock High, and injection of the treated water would occur east of the Bedrock High. Some of the injection wells would be along the northern edge of the plume to keep the plume from moving in that direction, and others would be in the central portion of the plume. The extracted water would be treated for VOCs to meet drinking water standards. Inorganics in this extraction area do not occur at levels that would require treatment before reinjection or discharge to surface water.

Additional information regarding the bedrock high was collected by Motorola after completion of the Interim Remedy Feasibility Study. This information indicates that the effectiveness of Alternative 21, as configured in the feasibility study, would be dramatically reduced.

The extraction and treatment system would contain approximately 1.5 additional square miles of the contaminant plume and remove approximately 1350 gallons of TCE from the aquifer over a 20 year period. (Gallons of TCE removed is supplied for comparison purposes. Other VOCs would also be removed.) The capture zone (see Figure 5) will be achieved within one year of system start-up.

Capital costs for this alternative are estimated to be \$7,000,000 and annual operation and maintenance costs are \$1,160,000. The present value is calculated to be \$21,000,000.

Alternative 64R - Extraction near I-10, Treatment for VOCs, and Reiniecton

This location for a containment line represents the western edge of the area originally studied for a final remedy. There is sufficient hydrogeologic characterization to support remedial actions up to Interstate 10. Extraction wells would be located near Interstate 10. The extracted water would be treated for VOCs to meet drinking water standards. Inorganics in this extraction area do not occur at levels that would require treatment before the beneficial use. The treated water would be injected back into the ground. Some of the injection wells would be located east of Interstate 10 at the northern edge of the plume to keep contaminants from moving in that direction, and others would be in the central portion of the plume.

The extraction and treatment system would contain approximately 2.6 additional square miles of the contaminant plume and remove approximately 2000 gallons of TCE from the aquifer over a 20 year period. (Gallons of TCE removed is supplied for comparison purposes. Other VOCs would also be removed.) The capture zone (see Figure 5) will be achieved within one year of system start-up.

Capital costs for this alternative are estimated to be \$9,160,000 and annual operation and maintenance costs are \$1,770,000. The present value is calculated to be \$31,000,000.

Alternative 64C - Extraction near I-10, Treatment for VOCs, and Discharge to the Grand Canal

Alternative 64C was developed in the Supplement to Interim Remedy Feasibility Study report to present another beneficial end-use for this extraction location. This alternative is similar to Alternative 64R, however treated water would be piped to the Grand Canal for irrigation use. Extraction wells would be located near Interstate 10. The extracted water would be treated for VOCs to meet drinking water standards. Inorganics in this extraction area do not occur at levels that would require treatment before the beneficial use.

The extraction and treatment system would contain approximately 2.6 additional square miles of the contaminant plume and remove approximately 2250 gallons of TCE from the aquifer over a 20 year period. (Gallons of TCE removed is supplied for comparison purposes. Other VOCs would also be removed.) The capture zone (see Figure 5) will be achieved within one year of system start-up. As is the case with Alternative 11C, discharge to the Grand Canal will be interrupted for approximately one month every year. Similar alternatives exist to allow continued operation of the extraction system, although the additional costs of such discharge alternatives are not included in the cost figures below.

Capital costs for this alternative are estimated to be \$7,390,000 and annual operation and maintenance costs are \$1,640,000. The present value is calculated to be \$28,000,000.

8. Summary of Comparative Analysis of Alternatives

ADEQ and EPA analyzed and compared the remedial alternatives developed in the Interim Remedy Feasibility Study and IRFS supplement based on the nine criteria in the National Contingency Plan. This section presents a summary of that comparative analysis of alternatives. The discussion below is summarized in Table 4.

Overall Protection of Human Health and the Environment

Overall protection of human health and the environment addresses whether a remedy provides adequate protection and describes how risks posed through each pathway are eliminated, reduced or controlled through treatment, engineering controls or institutional controls. Overall protection of human health and the environment and compliance with ARARs, which is addressed below, are the two "threshold criteria" that must be met for an alternative to be deemed acceptable.

All of the alternatives, except No Action, provide some degree of protection of human health and the environment without substantial negative impacts. Risk is reduced by removing contaminants from the environment, and inhibiting their westward migration. Alternatives 64C and 64R provide the largest area of containment (2.6 square miles of the plume) and also contain the largest mass of contaminants. Alternative 21 provides the next highest degree of containment (1.5 square miles), and Alternatives 11 and 11C provide the lowest degree of containment (0.7 square miles) relative to the other Alternatives. The difference between reinjection and discharge to the canal is not significant in terms of protection of human health. Negative impacts associated with the alternatives include the disruption that would result from installation of pipelines and other components of the remedy, and the impacts of handling, treating and disposing of residuals (e.g., air emissions and recovered solvents).

As this is an interim remedy, additional future actions may be required to reduce site-wide risks to an acceptable level.

The ecological risks from groundwater contamination within OU2 are not expected to be significant for the reasons stated in Section 6.

Compliance with ARARs

Compliance with Applicable or Relevant and Appropriate Requirements (ARARs) addresses whether a remedy will comply with Federal and State environmental laws and regulations that either apply to or are relevant and appropriate for the action being taken. All of the alternatives will comply with their respective ARARs. Cleanup of the aquifer to drinking water standards is not an ARAR because it is beyond the scope of this interim action for OU2. No ARARs waivers are expected to be needed.

Long-term Effectiveness and Permanence

Long-term effectiveness and permanence refers to the ability of a remedy to maintain reliable protection of human health and the environment over time. This criterion includes the consideration of residual risk and the adequacy and reliability of any controls.

TABLE 4. COMPARISON OF ALTERNATIVES

Criteria	No Action	11 Pump at Grand Canal & Reinject (Fluoride removal)	11C Pump at Grand Canal & discharge to canal	21 Pump at Bedrock High & Reinject	64C Pump at 1-10 & discharge to Grand Canal	64R Pump at 1-10 & Reinject
Overall Protection of Human Health & Environment	Will not prevent further downgradient and vertical migration of contaminated groundwater	Some reduction of risk by reducing contaminant mass through treatment of extracted water. Untreated contaminant mass downgradient of the capture zone is high relative to 21, 64C or 64R.	Some reduction of risk by reducing contaminant mass through treatment of extracted water. Untreated contaminant mass downgradient of the capture zone is high relative to 21, 64C or 64R.	Some reduction of risk by reducing contaminant mass through treatment of extracted water. Untreated contaminant mass downgradient of the capture zone is higher than with 64C or 64R.	Some reduction of risk by reducing contaminant mass through treatment of extracted water. Untreated contaminant mass downgradient of the capture zone is low relative to 11, 11C or 21.	Some reduction of risk by reducing contaminant mass through treatment of extracted water. Untreated contaminant mass downgradient of the capture zone is low relative to 11, 11C or 21.
ARARs Compliance	yes	yes	yes	yes	yes	yes
Long-term Effectiveness		Least effective based on area contained & VOC mass removed.	Least effective based on area contained & VOC mass removed.	More effective based on area contained & VOC mass removed.	Most effective based on area contained & VOC mass removed.	Most effective based on area contained & VOC mass removed.
Reduction of Toxicity, Mobility or Volume (TMV) Through Treatment	No reduction	Effectively destroys VOCs removed. Fluoride removed is disposed in landfill. Smallest containment area and lowest VOC mass removal.	Effectively destroys VOCs removed. Smallest containment area and lowest VOC mass removal. Intermittent canal availability.	Effectively destroys VOCs removed. Larger containment area than 11/11C and higher VOC mass removal.	Effectively destroys VOCs removed. Largest containment area and highest VOC mass removal. Intermittent canal availability.	Effectively destroys VOCs removed. Largest containment area and highest VOC mass removal.
Total capture area:		0.7 sq miles	0.7 sq miles	1.5 sq miles	2.6 sq miles	2.6 sq miles
Initial Rate of VOC Removal:		7.7 lbs/day	7.7 lbs/day	10.4 lbs/day	25.9 lbs/day	25.9 lbs/day

Criteria	No Action	11 Pump at Grand Canal & Reinject (Fluoride removal)	11C Pump at Grand Canal & discharge to canal	21 Pump at Bedrock High & Reinject	64C Pump at 1-10 & discharge to Grand Canal	64R Pump at 1-10 & Reinject
Short-term Effectiveness		Capture zone established within one year of startup. Potential VOC air emissions of 0.9 lbs/day. Moderate traffic disruptions during construction. Highest potential worker exposure to treatment chemicals.	Capture zone established within one year of startup. Potential VOC air emissions of 0.9 lbs/day. No traffic disruptions during construction. Low potential for worker exposure to treatment chemicals.	Capture zone established within one year of startup. Potential VOC air emissions of 1.2 lbs/day. Moderate traffic disruptions during construction. Lowest potential worker exposure to treatment chemicals.	Capture zone established within one year of startup. Potential VOC air emissions of 2.9 lbs/day. Minimal traffic disruptions during construction. Low potential for worker exposure to treatment chemicals.	Capture zone established within one year of startup. Potential VOC air emissions of 2.9 lbs/day. Highest level of traffic disruptions during construction. Low potential for worker exposure to treatment chemicals.
Implementability		Technical feasibility is high. Administrative feasibility is moderate based on number of wells and length of pipelines.	Technical feasibility is high. Administrative feasibility is highest based on number of wells and length of pipelines.	Technical feasibility is moderate due to uncertainties regarding impact of bedrock high on extraction. Administrative feasibility is moderately high based on number of wells and length of pipelines.	Technical feasibility is moderately high based on the extent of hydro-geologic characterization. Administrative feasibility is high based on number of wells and length of pipelines.	Technical feasibility is moderately high based on the extent of hydro-geologic characterization. Administrative feasibility is moderate based on number of wells and length of pipelines.
Cost (in \$000):						
Capital :	0	11,950	3,780	7,000	7,390	9,160
O&M :	0	2,450	1,260	1,160	1,640	1,770
Present Value:	\$0	\$40,000	\$19,000	\$21,000	\$28,000	\$31,000

Criteria	No Action	11 Pump at Grand Canal & Reinject (Fluoride removal)	11C Pump at Grand Canal & discharge to canal	21 Pump at Bedrock High & Reinject	64C Pump near I-10 & discharge to Grand Canal	64R Pump near I-10 & Reinject
State Acceptance						ADEQ prefers this alternative.
Community Acceptance	No support	Several commentors preferred this alternative. Others supported this alternative in combination with 64R.	One commentor noted that discharges to the canal would not be possible year-round.	No commentors supported this alternative.	One commentor preferred this alternative over 64R. One commentor noted that discharges to the canal would not be possible year-round. Several commentors opposed this extraction location due to potential adverse impacts on other sources of contamination and incomplete hydrogeologic characterization of the entire capture zone.	Several commentors opposed this extraction location due to potential adverse impacts on other sources of contamination and incomplete hydrogeologic characterization of the entire capture zone.

As this is an interim remedy, long-term effectiveness is not a critical factor; however, this interim action, in conjunction with other actions, will contribute to long-term effective control of groundwater contamination. Each of the alternatives should be effective in capturing contaminated groundwater with its containment area. The magnitude of risk remaining is a function of the extent of contamination within OU2 that is not captured by a given alternative. Thus, for example, because Alternatives 64C and 64R have the largest capture zone, these alternatives would minimize the magnitude of remaining risk. A final remedy for the site is expected to be identified within five years of this Record of Decision.

Reduction of Toxicity, Mobility or Volume Through Treatment

Reduction of toxicity, mobility or volume refers to the preference for a remedy that uses treatment to reduce health hazards, contaminant migration, or the quantity of contaminants at the site.

All of the alternatives, except No Action, use permanent destruction as the primary element to address the principal threat of contamination. Groundwater treatment alternatives include activated alumina adsorption for inorganics and either air stripping or advanced oxidation for VOCs. Advanced oxidation would destroy VOCs at the treatment plant, while off-site incineration of captured VOCs would be used in conjunction with air stripping. Inorganics (primarily fluoride) removed in Alternative 11 would be precipitated in the form of calcium fluoride and disposed of in a landfill, thereby reducing the volume of fluoride-contaminated media and its mobility, although the fluoride itself would not be destroyed.

The alternatives differ substantially in terms of the VOC contaminant mass contained within their capture zones and in the initial rate of VOC removal. Alternatives 64C and 64R have the largest containment areas and the highest rates of VOC removal (approximately 26 lbs/day), while Alternatives 11 and 11C have the smallest containment areas and lowest VOC removal rates (approximately 8 lbs/day). Alternative 21 was estimated to have a containment area about twice the size of Alternatives 11 and 11C but a VOC removal rate (10.4 lbs/day) that was only 25 % higher than 11 or 11C. Estimates of TCE removed, as listed in the IRFS, for alternatives including reinjection of treated water (Alternatives 11 and 64R) are slightly lower than estimates for their counterparts including discharge of treated water to the Grand Canal (Alternatives 11C and 64C) due to the effects of injecting water treated for VOCs upgradient of the extraction wells.

Short-term Effectiveness

Short-term effectiveness refers to the period of time needed to complete the remedy and any adverse impacts on human health and the environment that may be posed during the construction and implementation of the remedy. The following were used to evaluate the short-term effectiveness of each alternative: protection of the community and workers during remedial actions; environmental impacts from implementation of alternatives; and the length of time until remedial objectives are met.

In this interim remedy, additional capture of contaminated groundwater is a primary objective.

All of the alternatives, except No Action, would achieve this objective within one year of system startup, although the plume area and contaminant mass captured varies significantly among alternatives. For each alternative, the treatment plant would have air emission controls to reduce VOC emissions below the allowable maximum (unless advanced oxidation is used, in which case emission controls are not needed). These controlled air emissions would range from approximately 0.9 lbs/day for alternatives 11 and 11C to 2.9 lbs/day for alternatives 64C and 64R.

Soil contamination is not expected where construction would occur for any of the alternatives, however safety risks associated with construction activities would temporarily affect the community. The degree of this safety risk varies with the quantity and type of facilities required by each alternative. Traffic disruptions would be caused during well and pipeline installation. Alternative 11C would cause no traffic disruption. Alternative 64C would require 5 street crossings and 14,650 feet of piping in rights-of-way. Alternatives 21 and 11 are similar in requiring 8 street crossings each and 22,900 and 29,400 feet of piping, respectively, in rights-of-way. The most disruptive alternative is 64R, with 19 street crossings and 24,500 feet of piping in rights-of-way.

Under Alternative 21, workers operating and maintaining remedial facilities would have the least potential exposure to recovered solvents and treatment chemicals. Alternative 11C would cause the next least potential exposure. Alternatives 64R and 64C would have similar potential for exposure after Alternative 11C, and Alternative 11 would have the most potential. Treatment chemicals include acids and caustics, biocide, and lime.

Implementability

Implementability refers to the technical and administrative feasibility of a remedy, including the availability of materials and services needed to implement the selected remedy. It also includes coordination of Federal, State and local governments to clean-up the site.

Factors evaluated to determine technical feasibility include unknowns associated with construction and operation of a technology, reliability, level of hydrogeologic characterization, and ease of supplementing the remedy, if necessary. All of the technologies incorporated in the alternatives are reliable and effective for treating the target contaminants. Hydrogeologic characterization is highest in the area of Alternatives 11 and 11C, where the density of data is higher. Hydrogeologic data density is lower in the area of Alternatives 64C and 64R. The incomplete characterization of the bedrock high results in a limited understanding of hydrogeology in the area of Alternative 21. The reliability of Alternatives 64C and 64R is less certain than 11 and 11C because of the potential for uncharacterized/unknown sources to contribute contaminants that are incompatible with the treatment system. Each alternative would allow additional remedial actions to be taken, except that enhancements to reinjection (such as stimulation of *in situ* bioremediation of groundwater) are not readily implementable in Alternatives 11C and 64C, which do not include reinjection wells.

Administrative feasibility is a function of the need to coordinate with other agencies and of the amount of facilities required by each alternative that will be subject to approvals and permitting requirements. For this interim action, the most significant factors are the lengths of pipeline and

number of wells to be installed. On this basis, Alternative 11C would have the highest ranking for administrative feasibility, 64C would rank second, and the remaining alternatives would all rank significantly lower.

Cost

This criterion examines the estimated costs for each remedial alternative. For comparison, capital costs, operation and maintenance (O&M) costs, and the present value of capital and O&M costs are used to compare each alternative. In the Interim Remedy Feasibility Study, present values were calculated using a 5% discount rate and 20 years of operation. The assumption of a 20-year project life reflects EPA Superfund guidance; it does not reflect any specific finding regarding the duration of the interim remedy.

The cost of each alternative is shown in the table beneath Figure 5. On the basis of present value, Alternative 11C has the lowest cost (\$19,000,000), followed in order by 21, 64C, 64R and 11. The substantially higher costs for Alternative 11 (\$40,000,000) are primarily due to the capital and O&M costs of fluoride removal.

State Acceptance

State acceptance indicates whether, based on its review of the Remedial Investigation, Feasibility Study, and Proposed Plan, the state in which the site resides agrees with the preferred alternative. ADEQ is the lead agency for this site and has prepared this Record of Decision. Acceptance of this decision by the support agency, EPA, is indicated by EPA's concurrence and signature in Section I, Declarations.

Community Acceptance

Community acceptance is reflected in the community's support for, reservations about, or opposition to the various components of the alternatives. Fifteen individuals and organizations submitted comments on the Interim Remedy Feasibility Study, the IRFS Supplement, and the Proposed Plan for Operable Unit Two. These comments, and ADEQ's responses, are presented in the Responsiveness Summary (Appendix B of this Record of Decision). Comments from individuals, a citizens' group and organizations (including Potentially Responsible Parties, or PRPs) supported the idea of additional plume containment. Both the community and the PRPs (except one) felt that the proposed location for groundwater extraction was questionable due to incomplete hydrogeologic characterization and unclear effects of pumping on other sources of contamination. One PRP concurred with the selection of extraction near Interstate 10, but preferred Alternative 64C over 64R. The Gateway Neighborhood Coalition and other potentially responsible parties preferred groundwater extraction locations associated with Alternative 11, where they believe better hydrogeologic characterization exists, and where no other identified sources of contamination exist. One PRP recommended a combination of the proposed Alternative 64R and Alternative 11.

9. Selected Remedy

Based on consideration of the comparative analysis of alternatives and the requirements of the NCP, ADEQ and EPA have selected Alternative 64R as the interim remedial action for Operable Unit Two at the Motorola 52nd Street site. The remedial objectives of this interim action are to establish a capture zone across the entire width and depth of the contaminant plume, and to reduce concentrations of contaminated groundwater within the alluvial aquifer upgradient of the extraction wells. An additional objective of this remedy is to collect and analyze groundwater quality, groundwater flow, and other hydrogeologic data during implementation and operation of the remedy to support the selection of additional remedial actions for the site.

The elements of the selected remedy include:

- Installation of extraction wells near Interstate 10 and Van Buren Street. The extraction wells will pump water from the alluvial aquifer at an estimated rate of 4,000 gallons per minute. The actual location, number of wells and pumping rate, to be determined during remedial design, will be based on the objective of capturing the entire north-south width and depth of the contaminant plume exceeding MCLs for TCE.
- Contaminated groundwater withdrawn from the extraction wells will be treated to remove, as necessary, contaminants listed in Table 1. Treatment of contaminated groundwater will be conducted in a treatment facility located near the extraction wells using air stripping with off-gas treatment by synthetic resin adsorption. Recovered solvents will be transported to an approved facility for destruction. If design considerations indicate that the advanced oxidation treatment process would be effective and economical, ADEQ will consider approving the use of this technology in lieu of air stripping.
- Treated water will be piped to injection wells for injection back into the aquifer. The injection wells will be located in a manner to facilitate hydraulic containment of the contaminant plume and to provide the option of enhancing in-plume remediation.
- The remedy shall include the installation and sampling of groundwater monitoring wells, the sampling of existing monitoring wells, measurement of water levels at monitoring, extraction and injection wells, and the measurement of other aquifer properties in order to:
 - 1) evaluate the effectiveness of the remedy in meeting the remedial objectives.
 - 2) verify or revise contaminant influent concentration estimates that will be used in the design of the OU treatment facilities.
 - 3) provide an early warning network so that changes in the groundwater flow regime or contaminant concentrations that may require modifications in extraction rates, well locations or treatment methods are identified in time to institute the necessary facility and operational changes.

- 4) help determine the need for implementing additional remedial actions in Operable Unit Two and the nature of the final remedy.

Groundwater monitoring shall begin during the time of remedial design to provide data necessary to complete the final design and to establish pre-implementation conditions.

Containment of the plume at this location will be achieved within one year of system start-up. This interim remedy will continue to operate and will be combined with additional remedies leading to the final remedy for the site.

Locating the extraction wells near Interstate 10 captures a significantly larger area of the contaminant plume, and also contaminant mass, than would be achieved by locating them at the Grand Canal. Containment of this larger mass of contaminants is more protective of human health since it will reduce the future adverse impacts on downgradient water users and uncontaminated areas of the alluvial aquifer. Extraction in this location also captures contaminants from other known and unknown sources. The fact that inorganic contaminants are not addressed by Alternative 64R is not seen as a significant drawback, since removal of inorganic contaminants under Alternative 11 would be done solely because fluoride levels near the Grand Canal are high enough to require treatment in order to meet reinjection requirements (i.e., it would not produce any significant benefits to residents in this area of the site since the groundwater is not used as a source of domestic drinking water supply and fluorides in groundwater do not otherwise pose a health risk). The uncertainties concerning the nature of the bedrock high clearly make selection of a remedy at that location inadvisable, but those uncertainties do not have a significant impact on the effectiveness of Alternative 64R. The intermittent availability of the Grand Canal to accept treated water makes alternatives with this component undesirable.

Extraction near Interstate 10 creates a large capture zone that may include plumes from sources other than Motorola. Based on the available data, which ADEQ believes sufficient for the purposes of remedy selection, there is no reason to believe that the treatment system cannot be modified to effectively remove contaminants that would otherwise be incompatible with air stripping. The groundwater monitoring program which is a part of the remedy will provide the necessary information to design and implement such modifications if they are needed.

Implementation of Alternative 64R has the potential for significant traffic disruptions during construction of pipelines and installation of wells. ADEQ will work with affected residents and businesses during remedial design and construction to insure that adverse impacts are reduced to the extent practicable.

10. Statutory Determinations

Section 121 of CERCLA establishes several statutory requirements and preferences that address the selection of a remedial action. When complete, a remedial action must comply with applicable or relevant and appropriate environmental standards established under Federal and State environmental laws unless a waiver is justified. The selected remedy must also be cost-effective and utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable. Finally, the statute includes a

preference for remedies that employ treatment that permanently and significantly reduce the volume, toxicity, or mobility of hazardous substances as their principal element. The following subsections discuss how the selected remedy meets these statutory requirements.

Protection of Human Health and the Environment

The Risk Assessment performed by ADHS identified potential exposure pathways at this site. These pathways include drinking contaminated water from a well tapping into the contaminated aquifer. By capturing and containing a major portion of the existing contaminant plume, the selected remedy reduces the potential for degradation of downgradient portions of the aquifer and thus reduces the risk of exposure of downgradient water users. The selected treatment technologies for extracted water will provide permanent destruction of VOCs removed during containment pumping, thereby avoiding any cross-media transfer of VOCs.

Implementation of this remedy will proceed quickly and will not pose any unacceptable short-term risks to the workers and surrounding community.

Compliance with ARARs

Pursuant to Section 121(d) of CERCLA, the on-site portion of a remedial action selected for a Superfund site must comply with all Applicable or Relevant and Appropriate Requirements (ARARs). Any portion of a remedial action which takes place off-site must comply with all laws legally applicable at the time the off-site activity occurs, both administrative and substantive. According to the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) (40 CFR Part 300), "applicable" and "relevant and appropriate" are defined as follows:

- *Applicable requirements* means those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under federal environmental or state environmental or facility siting laws that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance found at a CERCLA site. Only those state standards that are identified by a state in a timely manner and that are more stringent than federal requirements may be applicable.
- *Relevant and appropriate requirements* means those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under federal environmental or state environmental or facility siting laws that, while not "applicable" to a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site, address problems or situations sufficiently similar to those encountered at the CERCLA site that their use is well suited to the particular site. Only those state standards that are identified in a timely manner and are more stringent than federal requirements may be relevant and appropriate.

Requirement are also classified as chemical-specific, location-specific, or action-specific.

- *Chemical-specific ARARs* are health- or risk-based concentration limits, numerical values, or methodologies for various environmental media (i.e., groundwater, surface

water, air, and soil) that are established for a specific chemical that may be present in a specific media at the site, or that may be discharged to the site during remedial activities. These ARARs set limits on concentrations of specific hazardous substances, pollutants, and contaminants in the environment. Examples of this type of ARAR are ambient water quality criteria and drinking water standards.

- *Location-specific ARARs* set restrictions on certain types of activities based on site characteristics. Federal and State location-specific ARARs are restrictions placed on the concentration of a contaminant or the activities to be conducted because they are in a specific location. Examples of special locations possibly requiring ARARs include flood plains, wetlands, historic places, and sensitive ecosystems or habitats..
- *Action-specific ARARs* are technology- or activity-based requirements which are triggered by the type of remedial activity. Examples are Resource Conservation and Recovery Act (RCRA) regulations for waste treatment, storage, and disposal.

Neither CERCLA nor the NCP provide across-the-board standards for determining whether a particular remedy will result in an adequate cleanup at a particular site. Rather, the process recognizes that each site will have unique characteristics that must be evaluated and compared to those requirements that apply under the given circumstances. Therefore, ARARs are identified on a site-specific basis from information about specific chemicals at the site, specific features of the site location, and actions that are being considered as remedies.

Table 5 provides an outline of the location- and action-specific ARARs that apply to this site and to this interim remedy. Because the selected remedy is an interim remedy, it may not achieve final cleanup levels for the groundwater and no chemical-specific ARARs for aquifer cleanup are included.

The selected remedy will comply with all applicable or relevant and appropriate requirements. Since the selected remedial action for Operable Unit Two is an interim action, cleanup requirements for the aquifer such as attaining MCLs, which would be ARARs for a final remedy, are not ARARs for this remedy. ARARs for the selected remedy are identified in Table 5.

Cost Effectiveness

ADEQ believes that the selected remedy is cost-effective in providing control of the contaminated groundwater in a reasonable period of time. Section 300.430 of the NCP requires cost-effectiveness be evaluated by comparing all the alternatives which meet the following criteria: protection of human health and the environment; long-term effectiveness and permanence; reduction of toxicity, mobility or volume through treatment; and short-term effectiveness. While long-term effectiveness will be addressed by the final remedy, the selected interim remedy meets these remaining criteria and provides for overall effectiveness in proportion to its cost. The estimated present worth for the selected remedy is \$31,000,000.

Table 5. Location- and Action-Specific Applicable, or Relevant and Appropriate Requirements (ARARs) of federal and state laws.

Citation	Requirement
Location-specific ARARs	
Endangered Species 16 U.S.C. §1531 et seq.	If endangered species are found within or adjacent to the site, remedial actions shall comply with the requirements for endangered species in accordance with the Endangered Species Act.
Fish and Wildlife 16 U.S.C. §661 et seq., 40 CFR §6.302	Remedial actions shall protect the fish and wildlife of the area in accordance with 16 USC §661 et seq.
National Archeological and Historical Preservation Act, 16 U.S.C. §469, 36 CFR Part 65, A.R.S. §41-841 -847 and A.R.S. §41-865	The laws governing archaeological discovery and preservation shall be followed if artifacts or human remains are discovered.
Action-specific ARARs	
New Well Construction & Groundwater Use Requirements Arizona Revised Statutes, Title 45; 45 A.R.S. §454.01; and §45-594, -595 and -596	Section 45-454.01 of the Arizona Groundwater Management Act (GMA) is relevant and appropriate to the site. For activities conducted onsite, the substantive portions of the provisions within the GMA are applicable. Remedial actions undertaken pursuant to CERCLA must meet the following requirements: a new well is subject to sections 45-594 (Well construction standards); 45-595 (Well construction requirements; licensing of well drillers and pump installation contractors); withdrawn groundwater must be reinjected into the aquifer or be put to reasonable and beneficial use, and a person who uses groundwater withdrawn in an active management area may be subject to the withdrawal fee and shall use the groundwater only pursuant to Articles 5-12 of Title 45, Chapter 2; and 3.

Table 5. (continued) Location- and Action-Specific Applicable, or Relevant and Appropriate Requirements (ARARs) of federal and state laws.

Citation	Requirement
<p>Arizona Air Pollution Control Regulations A.R.S. 49-401 et seq. Maricopa County Air Pollution Control Regulations Rules 200, 210,220 and 320</p>	<p>As a part of the delegated program, the Maricopa County Air Pollution Control Regulations adopted by the Board of Supervisors, October 1, 1990, Maricopa County Air Quality Standards (Rules 200, 210,220 and 320) are a part of the State Implementation Plan as dictated by the Clean Air Act and/or 40 CFR 264, Subparts AA and BB. The substantive portions of the regulations are applicable for remediation of groundwater at the site.</p>
<p>Discharge to Aquifer A.R.S. §49-241 through 49-244.</p>	<p>Portions of the Arizona statutory code for discharge to an Aquifer, (defined in A.R.S. 49-201, 203 and 49-241, et seq) and implementing regulations (A. A. C. R18-9-101, et seq.) are applicable to the Motorola 52nd Street Site. If Motorola discharges it shall comply with the substantive requirements for an Aquifer Protection Permit.</p>
<p>Air stripper Emissions Resource Conservation and Recovery Act (RCRA) (40 C.F.R. Part 265, Subpart AA and BB)</p>	<p>The RCRA requirements apply to air emission standards for process vents and equipment leaks associated with distillation, solvent extraction or air stripping operations. The requirements impact those operations that manage hazardous waste with organic concentrations of at least 10 parts per million. These requirements are applicable.</p>
<p>"Contained in" principle Arizona Hazardous Waste Management Act (AAC R18-8-261)</p>	<p>The "contained in" principle provides that any non-waste material (e.g., groundwater) that contains a listed hazardous waste must be managed as if it were a hazardous waste. Groundwater extracted as part of this interim remedy will contain a listed hazardous waste, therefore these regulations are applicable to the management of that groundwater.</p>

Table 5. (continued) Location- and Action-Specific Applicable, or Relevant and Appropriate Requirements (ARARs) of federal and state laws.

Citation	Requirement
Arizona Hazardous Waste Management Act, AAC R18-8-262	The regeneration or disposal of spent carbon or other media after use to control emissions of VOCs must be managed in conformance with the generator requirements of the state Hazardous Waste Management Act, including disposal at a permitted hazardous waste facility.
Arizona Hazardous Waste Management Act Land Disposal Restrictions, AAC R18-8-268	Groundwater treatment residuals or other media contaminated with volatile organic compounds are banned from land disposal. Treatment standards must be met before wastes can be land disposed.
Arizona Hazardous Waste Management Act, AAC R18-8-264 (40 CFR Subpart X)	Air stripping towers are miscellaneous RCRA units, therefore, the substantive requirements of 40 CFR Subpart X, including any closure and post-closure care, will be applicable or relevant and appropriate.
Other Action-specific requirements	
Air stripper Emissions EPA OSWER Directive 9355.0-2.8, June 1989	The OSWER directive shall be met for control of air emissions from air strippers used at a Superfund site for groundwater treatment. Controls will be required as part of this interim remedy on sources with an actual emission rate of 3 lb/hr or 15 lb/day or a potential rate of 10 tons per year of total VOCs because VOCs are ozone precursors.

Utilization of Permanent Solutions and Alternative Treatment Technologies or Resource Recovery Technologies to the Maximum Extent Practicable

The State of Arizona and EPA have determined that the selected interim remedy represents the maximum extent to which permanent solutions and treatment technologies can be utilized in a cost-effective manner for the limited scope of this action. The primary factor in selecting Alternative 64R for this interim remedy was the reduction of toxicity, mobility, or volume of contaminants through treatment. Alternative 64R captures the largest area of contamination. The selected remedy also permanently removes and destroys the VOC contamination in the groundwater, thereby utilizing permanent solutions and treatment technologies to the maximum extent practicable.

Preference for Treatment as a Principal Element

VOC contaminated groundwater will be extracted, and the VOCs removed by either air stripping or advanced oxidation. VOC vapors from air stripping will be captured and concentrated through synthetic resin adsorption for off-site incineration. Therefore, this remedy satisfies the statutory preference for remedies that employ treatment of the principal threat which permanently and significantly reduces toxicity, mobility, or volume of hazardous substances as a principal element.

11. Documentation of Significant Changes

The Proposed Plan for Operable Unit Two was released for public comment in January 1994. The Proposed Plan identified Alternative 64R (extraction near Interstate 10, treatment to remove VOCs and disposal through injection wells) as the preferred alternative. ADEQ reviewed all written and oral comments submitted during the public comment period. Upon review of these comments, it was determined that no significant changes to the remedy, as it was originally identified in the Proposed Plan, were necessary.

Comments on the Proposed Plan suggested that Alternative 64C (with discharge to the Grand Canal) was preferable to 64R because the costs and traffic disruptions were lower and because there would be a more immediate beneficial use of the treated water. However, the Salt River Project, which maintains and operates the canal, noted in their comments that treated water could not be discharged during the annual month-long maintenance of the canal and that there may be times when irrigation demands were too low to allow the discharge of 4,000 gpm. Because of these uncertainties about the continuity of discharge to the canal and the resulting undetermined impacts on maintaining the capture zone if extraction flows had to be reduced or temporarily stopped, ADEQ did not select 64C. Nonetheless, ADEQ is willing to consider and evaluate, during remedial design, a treated water disposal option that incorporates both reinjection and canal discharge if it is economical and does not reduce the effectiveness of the remedy.

ATTACHMENT B

STATEMENT OF WORK FOR REMEDIAL ACTION**MOTOROLA 52ND STREET SUPERFUND SITE, OPERABLE UNIT 2
PHOENIX, ARIZONA**

ATTACHMENTS

Attachment 1. Summary of Major Submittals for the Remedial Action at Motorola 52nd Street	12
Attachment 2. Regulation and Guidance Documents	14

1.0 Introduction**1.1 Site Description**

The Motorola 52nd Street Superfund Site is located in Phoenix, Arizona. Activities at this site began in 1982 with the investigation of releases of hazardous substances from the Motorola, Inc. Semiconductor Products Plant at 5005 East McDowell Road, in the eastern portion of Phoenix, Arizona, in Maricopa County. Motorola, Inc. is conducting on and off-site groundwater treatment to approximately 40th Street. Releases of hazardous substances from the Allied-Signal facility at 111 South 34th Street have contributed to the groundwater contamination. The second interim remedy, operable unit two (OU2), addresses the contaminant plume from 40th Street to approximately 20th Street and is designed to inhibit the further migration of the plume. The aquifer in the contaminated portion of the basin is located both in alluvium and bedrock in the upgradient portion of the site. At the easternmost (upgradient) point of OU2, the unconfined water table lies approximately 20 feet below land surface. At the western boundary of OU2 the alluvium thickness is greater than 200 feet, with depths to groundwater of approximately 80 feet. Fourth quarter 1997 groundwater samples within the OU2 portion of the plume show maximum contaminant concentrations above drinking water standards of many volatile organic compounds (VOCs) including trichloroethylene (TCE), 1,1,1-trichloroethane (TCA), 1,1-dichloroethylene (DCE), 1,2-dichloroethylene (DCE), tetrachloroethylene (PCE) and vinyl chloride (VC).

1.2 Purpose

The purpose of this Statement of Work (SOW) is to set forth the framework and requirements for implementing the OU2 Remedial Action (RA) at Motorola 52nd Street in accordance with the OU2 Remedial Design (RD) and the Record of Decision (ROD) for OU2 issued on July 21, 1994 which defines the selected remedy. The major activities outlined in this SOW are: planning RA activities; implementing and testing the physical components of the groundwater treatment and monitoring system; performing system start-up; and performing two years of system Operations and Maintenance (O&M).

1.3 General Requirements

- 1.3.1 The Respondent shall conduct the RA in accordance with this SOW and the final plans and specifications developed during the RD. The RA shall also be consistent with the ROD issued on July 21, 1994 (or any EPA approved changes to the ROD as documented in the site file, a ROD Amendment or Explanation of Significant Difference), the *Remedial Design/Remedial Action (RD/RA) Handbook* (U.S. EPA Office of Solid Waste and Emergency Response (OSWER) 9355.0-04B, EPA 540/R-95/059, June 1995), and all other guidance used by EPA in conducting an RA. The primary contact for this work is Nadia Hollan tel. (415) 744-2363; the secondary contact is Michael Montgomery, tel. (415) 744-2362.

- 1.3.2 A summary of the major deliverables and a schedule for submittals is attached. See Attachment 1. RA shall be completed in accordance with the attached schedule and other requirements provided within the SOW.
- 1.3.3 Specifically, the RA involves the construction, start-up, and two years of operation & maintenance of a 5,300 gallon per minute (gpm) groundwater extraction and treatment system.
- 1.3.4 The Respondents shall furnish all necessary and appropriate personnel, including contractors and subcontractors, materials, and services needed for, or incidental to, performing and completing the RA.
- 1.3.5 A list of primary guidance and reference material is attached. See Attachment 2. In all cases, The Respondents shall use the most recently issued guidance.
- 1.3.6 The estimated cost of the RA, as outlined in the Preliminary (30%) RD cost estimate, is \$12.6 million for implementation and \$2.2 million annually for operation and maintenance.
- 1.3.7 The Respondents shall designate a representative who will communicate at least weekly with the Remedial Project Manager, either in face-to-face meetings or through conference calls.
- 1.3.8 The Respondents shall document all decisions that are made in meetings and conversations with EPA. The Respondents shall forward this documentation to the RPM within two (2) working days of the meeting or conversation.
- 1.3.9 EPA will provide oversight of activities throughout the RA. EPA review and approval of deliverables is a tool to assist this process and to satisfy, in part, EPA's responsibility to provide effective protection of public health, welfare, and the environment. EPA will review deliverables, including specific deliverables from the Supervising Contractor or subcontractors to the Respondents, to assess the likelihood that the constructed remedy will achieve its remediation goals and that its performance and operations requirements have been met. Acceptance of plans and design-required submittals (i.e., shop drawings, design details) by EPA does not relieve the Respondents, the Supervising Contractor, the constructor, or any other subcontractors from their professional responsibilities.

2.0 Project Planning and Support

2.1 Project Planning

The purpose of this activity is to plan for the execution and overall management of the RA. The technical and managerial activities required to implement the RA and the associated costs are developed during the planning phase and are detailed in the RA Work Plan. Activities required for general project management that will occur throughout the duration of the project are included in this section. This activity may begin before or after the approval of the final design package and will continue throughout the RA. The following activities shall be performed as part of project planning and support:

- 2.1.1 Select Supervising Contractor. Within thirty (30) days of the Effective Date of this Unilateral Administrative Order, Respondents shall notify the EPA in writing of the name, title, and qualifications of any contractor proposed to be the Supervising Contractor for the implementation of the RA. EPA shall issue either a written notice of disapproval or a written authorization to proceed.
 - 2.1.1.1 Disapproval of Supervising Contractor. If EPA issues a notice of disapproval, the Respondents shall, within fifteen (15) Days after receipt of such disapproval, submit to EPA a list of alternate contractors that would be acceptable to the Respondents, including the qualifications of each contractor. EPA shall provide written notice to

The Respondents of the name(s) of any contractor(s) that it disapproves and a written authorization to proceed with respect to any of the other contractors on the alternate contractor list. The Respondents may select any contractor from the alternate contractor list that is not disapproved by EPA and shall notify EPA in writing of the name of the selected contractor within thirty (30) Days after receipt of the EPA's approval of the alternate contractor list. The Respondents must obtain an authorization to proceed from EPA, and shall give such notice to EPA pursuant to this subparagraph, before the new Supervising Contractor performs, directs, or supervises any Work.

- 2.1.2 Attend Coordination Meetings. Before or concurrent with developing the RA Work Plan, the Respondents shall attend one or more coordination meetings to be held at the EPA Regional Office, or other location designated by the RPM.
- 2.1.3 Conduct Site Visit. The Respondents shall conduct a site visit with the EPA RPM and the Remedial Design representative(s) (designer) during the RA planning phase to assist in developing an understanding of the site and any construction logistics. Information gathered during the visit shall be used to better scope the project and to implement the RA. A Health and Safety Plan (HASP) is required for the site visit. The Respondents shall prepare a report that documents the site visit and any required action items or decisions. This report shall be submitted to the EPA RPM within ten (10) calendar days of the site visit.
- 2.1.4 Evaluate Existing Information. The Respondents shall obtain, copy (if necessary), and evaluate existing OU2 data and documents, including the Preliminary, Pre-Final, and Final Design Packages, the RD Work Plan, the ROD, Remedial Investigation/Feasibility Study (RI/FS), and other data and documents as directed by the RPM. This information shall be used to determine if any additional data are needed prior to procuring the constructor.
- 2.1.5 Work Plan. The Respondents shall prepare and submit a RA Work Plan which includes a detailed description of construction activities, operations and maintenance, performance monitoring, and an overall management strategy for the RA. After the submission of the Draft RA Work Plan, the Respondents shall present the general approach that will be used for the RA at a Work Plan coordination meeting with the RPM. This meeting will be held at the Region 9 office.
 - 2.1.5.1 Develop Draft Work Plan. The Respondents shall prepare and submit a Draft RA Work Plan within thirty (30) days after EPA's written authorization to proceed. The Respondents shall submit the original and three copies to the RPM. The Work Plan shall include a detailed description of the technical approach for the remediation and construction activities in accordance with the OU2 Final Design and ROD. The necessary procedures, inspections, deliverables, and schedules shall be specified. A comprehensive construction management schedule for completion of each major activity and submittal shall also be included. Specifically, the Work Plan shall present the following:
 - A brief site description and summary of site history.
 - A statement of the problem(s) and potential problem(s) posed by the site and how the objectives of the completed RA will address the problem(s).
 - The contractor's technical approach to each activity to be performed, including a detailed description of each activity; the assumptions used; the information needed for each activity; any information to be produced during and at the conclusion of each activity; and a description of the deliverables that will be submitted to EPA.
 - A schedule for specific dates for completion of each required activity and submission of each deliverable required by this SOW. (See Attachment 1). This schedule shall also include information about timing, initiation, and completion of all critical path milestones for each activity and deliverable and the expected review time for EPA.

- An organizational structure which outlines the responsibilities and authority of all organizations and key personnel involved in the RA. A description of key project personnel's qualifications (project manager, resident engineer, quality assurance official, etc.) shall be provided.
- A detailed schedule for each activity necessary for implementation of the RA including but not limited to: ordering and delivery of parts for all components of the construction; acquiring necessary titles, easements, agreements, options, or rights of way; and obtaining government permits, approvals, or requirements necessary for construction and operation of the treatment system and monitoring network.
- A project management plan addressing both project management and document control for all activities conducted during the work.

2.1.5.2 Attend Coordination Meeting. The Respondents shall attend a Work Plan coordination meeting at the Region 9 office. Any technical issues and possible solutions shall be discussed at this meeting. The Respondents shall confirm these discussions and suggested plan of action in a memorandum to the RPM within two (2) days of the meeting.

2.1.5.3 Final Work Plan. The Respondents shall make revisions to the Draft Work Plan as a result of EPA's comments and/or meeting agreements and submit the Final Work Plan within twenty-one (21) days after receipt of EPA's written comments on the draft Work Plan. The Final Work Plan shall also include any necessary updates or revisions to plans discussed in Section 4.0 of this SOW.

2.2 Project Management

2.2.1 Prepare Periodic Status Reports. Following the Effective Date of this UAO, the Respondents shall prepare Monthly Progress Reports documenting the technical progress and status of each activity in the SOW. The Progress Reports shall be due on the fifteenth (15th) day of each month following the reporting period.

2.2.2 Meeting Participation and Routine Communications. The Respondents shall attend project meetings, provide documentation of meeting results, and shall contact the RPM by telephone on a weekly basis to report project status.

2.2.3 Maintain Schedule Control System. The Respondents shall develop and maintain a system to monitor and control the schedule of the RA. The Respondents shall specify the process to continuously update the information in the system as a result of engineering network analyses and changing field conditions. The system shall have the capability to compare technical progress and predict completion dates.

2.2.4 Coordinate with Local Emergency Response Teams. The Respondents shall coordinate with local emergency responders to ensure the proper implementation of the HASP and specifically the Emergency Response Plan. The Respondents shall, if necessary, conduct a kickoff meeting at the site with all local emergency responders, and notify the responders of any changes to the Emergency Response Plan throughout the RA.

3.0 Community Relations

The Respondents shall provide community relations support to EPA throughout the RA. The Respondents shall provide community relations support in accordance with *Community Relations in Superfund: A Handbook*, June 1988. This activity begins with the submission of the Final RA Work Plan and continues throughout the duration of the work assignment. Community relations support shall include the following activities:

3.1 Public Meetings and Availability Support

- 3.1.1 Technical Support. The Respondents shall assist the RPM in providing technical support for community meetings that may be held during the RA. This support may include preparing technical input to news releases, briefing materials, arranging other community relations vehicles (i.e., site tours), and helping the RPM to coordinate with local agencies.
- 3.1.2 Logistical and Presentation Support. The Respondents shall assist the RPM in preparing technical briefing materials and in arranging for the logistical details for the meeting(s).
- 3.1.3 Public Notice Support. The Respondents shall assist the RPM in drafting public notices, announcing the public meetings and placing the notice in a local paper of general circulation.

3.2 Special Community Relations Projects

With approval of the RPM, the Respondents shall arrange for the construction of projects responsive to community needs which are not generally or specifically included in the construction tasks. This task may also include but not be limited to landscaping agreed upon by the RPM to mitigate the project impact on the community, if such work is not included in other construction tasks.

4.0 Site Specific Plans

The Respondents shall review the existing site-specific plans that were prepared during RD and earlier phases of OU2, and update, as necessary, to implement the RA. All necessary updates shall be included in the appendices to the Final Work Plan, and submitted according to the attached schedule in this SOW (see Attachment 1). Typical plans include a health and safety plan, sampling and analysis plan, and construction quality assurance plan. The Respondents have the overall responsibility to prepare, update, and/or maintain the necessary site-specific plans for implementation of the RA. The Respondents will incorporate the plans and procedures received from the Supervising Contractor and any subcontractors into the overall site plans. Construction plans and procedures are living documents and the Respondents shall update the appropriate plans, as necessary, throughout the RA.

4.1 Update Site Management Plan

The Respondents shall update the Site Management Plan (SMP) that was prepared during RD. This plan provides EPA with a written understanding of how access, security, health and safety, contingency procedures, management responsibilities, and waste disposal are to be handled during construction. The Respondents shall update the plan, as necessary, to incorporate any contractors' and/or subcontractors' plans.

- 4.1.1 Update Health and Safety Plan. The Respondents shall prepare a site-specific HASP that addresses overall health and safety considerations for all personnel on-site. The Respondents shall incorporate the constructor's and any subcontractors' HASPs into the overall site plan. The Respondents shall provide the overall framework for site safety and ensure that adequate warning systems and notifications are understood by all parties. The HASP shall specify employee training, protective equipment, medical surveillance requirements, standard operating procedures, and a contingency plan in accordance with [40 CFR 300.150 of the NCP and] 29 CFR 1910.120 1(1) and (1)(2). Whenever possible, refer to the HASP developed for the RI/FS or RD when preparing the HASP for the RA. For any site visits, a task-specific HASP must also be prepared to address health and safety requirements.
- 4.1.2 Update Sampling and Analysis Plan (Chemical Data Acquisition Plan). The Respondents shall prepare a Sampling and Analysis Plan (SAP) to reflect the specific objectives of any data acquisition conducted during construction. The SAP will outline the data collection and quality assurance requirements of any sampling and analysis conducted by the Respondents, and will consist of a Quality Assurance Project Plan, a Field Sampling Plan, and a Data Management Plan.

4.1.2.1 Quality Assurance Project Plan. The Respondents shall prepare a Quality Assurance Project Plan (QAPP) in accordance with EPA Requirements for Quality Assurance Project Plans (EPA QA/R-5) latest draft or revision. The QAPP shall describe the project objectives and organization, functional activities, and quality assurance/quality control (QA/QC) protocols that shall be used to achieve the desired data quality objectives (DQOs). The DQOs shall, at a minimum, reflect use of analytical methods for identifying contamination and addressing contamination consistent with the levels for remedial action objectives identified in the National Contingency Plan. The QAPP developed for the RD and/or RI/FS should be referenced or adapted whenever possible when preparing the QAPP for the RA.

4.1.2.2 Field Sampling Plan. The Respondents shall prepare a Field Sampling Plan (FSP) that defines the sampling and data collection methods that shall be used for the project. The FSP shall include sampling objectives; sample locations and frequency; sampling equipment and procedures; sample handling and analysis; and a breakdown of samples to be analyzed through the Contract Lab Program (CLP) and through other sources, as well as the justification for those decisions. The FSP shall consider the use of all existing data and shall justify the need for additional data whenever existing data will meet the same objective. The FSP shall be written so that a field sampling team unfamiliar with the site would be able to gather the samples and field information required. The FSP developed for the RD and/or RI/FS must be referenced or adapted whenever possible; the Respondents shall document any required changes to the FSP in a memorandum to the RPM.

4.1.2.3 Data Management Plan. The Respondents shall prepare a Data Management Plan that outlines the procedures for storing, handling, accessing, and securing data collected during the RA.

4.2 Update Pollution Control & Mitigation Plan

The Respondents shall prepare a Pollution Control & Mitigation Plan that outlines the process, procedures, and safeguards that will be used to ensure contaminants or pollutants are not released off-site during the implementation of the RA. Any plans and procedures prepared during the RD should be referenced or adapted whenever possible (i.e., sediment and erosion control plan and air monitoring plan).

4.2.1 Update Transportation & Disposal Plan (Waste Management Plan). The Respondents shall prepare a Transportation & Disposal Plan that outlines how wastes that are encountered during the RA will be managed and disposed of. The Respondents shall specify the procedures that will be followed when wastes will be transported off-site for storage, treatment, and/or disposal.

4.3 Update Construction Quality Assurance (CQA) Plan.

The Respondents shall prepare Construction Quality Assurance (CQA) Plan. The CQA Plan shall outline the necessary steps to inspect and sample construction materials (i.e., membranes, concrete) and to ensure the overall quality of the constructed project. The CQA Plan shall include the following elements:

- Responsibility and authority of all organization and key personnel involved in the remediation action construction.
- CQA Personnel Qualifications. The Respondents shall establish the minimum qualifications of the CQA Officer and supporting inspection personnel.
- Inspection Activities. The Respondents shall establish the observations and tests that will be required to monitor the construction and/or installation of the components of the RA(s). The plan shall include the scope and frequency of each type of inspection to be conducted. Inspections shall be required to verify compliance with environmental requirements and include, but not be limited to, air quality and emissions monitoring records, waste disposal records (e.g., RCRA transportation manifests), etc. Inspections shall also ensure compliance with all health and safety procedures.

- Sampling requirements. The Respondents shall establish the requirements for sampling activities, sample size, sample locations, frequency of testing, criteria for acceptance and rejection, and plans for correcting problems as addressed in the project specifications.
- Documentation. The Respondents shall describe the reporting requirements for CQA activities. This shall include such items as daily summary reports and inspection data sheets.

4.4 Develop Other Plan(s). As the RPM or the Respondents deem necessary, the Respondents shall develop any other plans appropriate for inclusion in the Work Plan.

5.0 Construction Requirements

5.1 RA Construction

The Respondents shall construct the complete treatment system and necessary monitoring network within three hundred sixty-five (365) days after approval of the Final Work Plan and in accordance with the ROD, this SOW and the final plans and specifications developed during the RD. The Respondents shall comply with all ARAR's identified in the ROD and/or by the EPA RPM. At a minimum, the constructed extraction system shall maintain a Zone of Capture that will prevent the entire north-south width and depth of groundwater in excess of MCLs from migrating further downgradient, and the constructed treatment system shall treat the extracted water so that the effluent water quality at the point of discharge meets the ARARs as specified in the OU2 ROD. Components of the constructed treatment system shall include:

- Wells for extracting groundwater from the OU2 Area to be located in the approximate vicinity of Interstate 10 and Van Buren Street.
- A treatment facility for treatment of extracted groundwater.
- Pipelines for conveying extracted groundwater to the treatment facility located near the extraction wells.
- Pipelines for conveying treated water from the treatment facility to the point(s) of discharge(s).
- Any necessary treated water discharge materials or equipment.
- Any monitoring network construction necessary to evaluate System performance and contaminant capture, consistent with the OU2 ROD.
- Any additional construction deemed necessary to complete the treatment system.

5.2 Design or Construction Modifications

The Respondents may propose modifications to the work based on new data or other relevant information. The Respondents shall submit any requests for modifications in writing to the RPM in a Technical Memorandum. The Technical Memorandum must describe what changes need to be made, the basis for such changes, and the impact of changes on the construction schedule. The RPM must approve the Technical Memorandum in writing before implementing the changes. A Technical Memorandum must also be submitted at the request of the RPM if any design changes or modifications are deemed necessary by the RPM.

5.3 Construction Completion and Notification

The Respondents shall complete construction and operational testing of the system within three hundred sixty-five (365) days of approval of the Final Work Plan. The Respondents shall submit a written notification documenting completion of construction of the treatment system to EPA within fifteen (15) days after completion of construction and operational testing of the treatment system. The Respondents shall also schedule a pre-final inspection at this time as described in section 7.1.

6.0 Start-Up and Operation and Maintenance [O&M] Planning

The purpose of this activity is to document the tasks necessary to operate and maintain the treatment system for protection of the integrity of the remedy and to evaluate system performance during start-up and over long-term operation. This activity begins during the later stages of construction with the preparation of the Draft O&M manual

and continues after the submittal of the Final O&M Manual as occasional updates and revisions to the manual will be necessary.

6.1 Prepare Operation and Maintenance (O&M) Manual

The Respondents shall prepare and submit a Draft O&M Manual within three-hundred (300) days from the approval of the Final Work Plan. The Draft O&M Manual should be revised within thirty (30) days after construction completion and operational testing of the constructed system. The Final version of the manual shall be submitted to the RPM within 30 days after receipt of EPA comments. The O&M Manual(s) shall include but not be limited to the following sections.

- 6.1.1 Equipment Start-up and Operator Training: the initial and equipment start-up, and monitoring requirements; technical specifications governing treatment systems; requirements for providing appropriate service visits by experienced personnel to supervise the installation, adjustment, start-up, and operation of the systems; schedule for training personnel regarding appropriate operational procedures once start-up has been successfully completed.
 - 6.1.1.1 The Start-up Monitoring Plan shall provide:
 - monitoring schedules for chemical contaminants and/or hydrogeologic monitoring to be performed during the system calibration period.
 - specific objectives for sampling and analysis of groundwater from monitoring and extraction wells and sampling and analysis of treatment plant effluent using statistical process control methods and a description of calculations necessary to evaluate system performance with respect to surface and groundwater treatment objectives.
 - where applicable discharge standards are exceeded during start-up, a modified monitoring schedule to facilitate system compliance.
 - procedures to accurately document system compliance during start-up.
- 6.1.2 Operation and Maintenance (O&M): a description of routine tasks required for system operation maintenance such as procedures to ensure that the system continues to operate according to specification, including, but not limited to, scheduled visual inspections, scheduled cleaning and/or backflushing, and the use of any chemical additives for corrosion or pH control; description of prescribed treatment or operating conditions; schedule showing the required frequency for each O&M task, including a periodic review of statistical process control and operational data to ensure system operation is within standard operating ranges.
- 6.1.3 Potential Operating Problems: a description and analysis of potential operating problems; sources of information regarding problems; and common remedies or anticipated corrective actions including procedures for shut-down of the system to be implemented in the event that problems are encountered. Specifically, the Respondents shall identify any potential system failures and develop corrective action plans, if necessary.
- 6.1.4 Routine Monitoring, Sampling and Laboratory Testing: a description of monitoring and sampling tasks (including monitoring of UV oxidation and liquid GAC systems); description of required laboratory tests and their interpretation; required QAPP; schedule of monitoring and sampling frequency and date; and a description of statistical process control plan with suggested variables and sampling plan with proposed control charts and control limits.
- 6.1.5 Performance Evaluation Calculations: calculations shall be presented for each contaminant of concern and each treatment process (as relevant) for determining the mass of contaminants extracted from aquifer to date (each well and combined), influent loading rates to treatment units, mass of contaminants removed to date, estimated UV system chemical usage and expected lifetime of UV lamp, estimated carbon usage and remaining carbon capacity, total water treated based on hour meter readings, compliance with VOC discharge limits,

estimations of frequency of carbon change-outs, and other relevant information needed for evaluating optimal system performance, as necessary.

- 6.1.6 Contingency Plan: procedures for notification of EPA in the event that operational data is not within standard operating ranges, or one or more of the contaminants of concern in the treated water exceeds one-half its applicable discharge standard, or if it is anticipated that operational data will not remain within standard operating ranges, or if operation, monitoring and maintenance activities are not performed according to the O&M Manual; and description of measures to be taken to bring the system back into compliance or ensure that the system remains in compliance. Alternative procedures to prevent undue hazard in the event of equipment failure such as a release or threatened releases of hazardous substances, pollutants or contaminants which may endanger public health or welfare or the environment or exceed cleanup standards; analysis of vulnerability and additional resource requirements should an equipment failure occur; mechanisms which will permit O&M to be modified in response to changing conditions.
- 6.1.7 Safety Plan: a description of precautions to be taken and required health and safety equipment for site personnel protection; and safety tasks required in the event of equipment failure.
- 6.1.8 Equipment: a list and description of equipment, including system control and monitoring components; and maintenance and replacement schedule for equipment.
- 6.1.9 Records and Reporting: operation log sheets; routine maintenance and service forms; orders placed with vendors; field activities; system performance anomalies; system shut-downs; component failures; summaries of meetings or discussions with subcontractors, engineers or operators; laboratory records; mechanism for reporting emergencies; and maintenance records. Copies of all operational monitoring and sampling documents, including the O&M Manual, laboratory results, logbook, forms, charts, and chain of custody sheets, shall be maintained in a central file location within the treatment facility.

7.0 System Start-Up

The purpose of the system start-up activities is for the Respondents to conduct the necessary inspections, evaluations, and monitoring to verify completed work and achievement of construction and operational performance standards.

7.1 Pre-final/Final Activities

- 7.1.1 Make pre-final/final construction inspection. Within fifteen (15) days of completion of construction and operational testing of the treatment system, the Respondents shall schedule and conduct a pre-final inspection with the constructor and develop a punch list of deficiencies. The Project Managers, Supervising Contractor, and a representative of the Construction Contractor will participate in the pre-final inspection. The Construction Inspection shall consist of a walk-through inspection of the entire project site and shall include an operational test of the treatment equipment. The Respondents shall prepare and submit a Pre-Final Inspection Report within thirty (30) days after the inspection which includes the list of deficiencies, completion dates for outstanding items, and the date for a final inspection.
- 7.1.2 Construction Completion Report. The Respondents shall submit a Final Inspection Report within fifteen (15) days of the Final Inspection. This report shall include the following:
 - A synopsis of the work completed as defined in this SOW;
 - A certification that the construction has been completed and meets the construction specifications, including specific operational standards;
 - As-built drawings signed and stamped by a professional engineer to certify that the drawings present a record of the completed construction; and

- An explanation of how construction items which required corrective action were or will be resolved.

- 7.1.3 EPA may require the Respondents to schedule an additional inspection or inspections to verify that all construction items that required correction have been addressed, and that the construction is complete and consistent with the UAO.

7.2 System Start-Up

The Respondents shall start the system after submission of the Construction Completion Report. The Respondents shall implement the Start-up Monitoring Plan and other relevant procedures and monitoring included in the Final O&M Manual and Final Work Plan.

- 7.2.1 Start-Up System and Evaluate Equipment. Equipment shall be evaluated for operating parameters and performance. At a minimum, the performance data to be collected shall be as needed to satisfy the requirements for preparing the Start-Up report required under Section 7.3.
- 7.2.2 Performance Tests Oversight. The Respondents shall oversee any performance tests conducted by the constructor and document procedures and results.
- 7.2.3 Gather and Test Samples. Samples shall be gathered and tested according to all relevant guidelines and plans to determine if the operating and treatment performance standards are being met by the system and to establish baseline criteria for the treatment system.

7.3 Report Project Start-Up Performance

- 7.3.1 The Respondents shall prepare a Start-Up Report summarizing the performance data collected during the start-up period and procedures taken to evaluate system performance. The Start-Up report shall document the sampling and testing done on the system to ensure the system meets treatment performance standards and will meet hydraulic containment performance standards within the required time. The Start-Up report shall be submitted within thirty (30) days of completion of Start-up activities.

8.0 RA Completion

8.1 Demobilization

- 8.1.1 Removal of Temporary Facilities. The Respondents shall dismantle, pack up, and move off-site any temporary facilities (i.e., trailers) or equipment used during the course of the RA.
- 8.1.2 Site Restoration. At the direction of the RPM, the Respondents shall conduct reasonable activities that restore the physical appearance of the site (i.e., road restoration, fence removal, limited landscaping).

8.2 Remedial Action Report

- 8.2.1 Prepare draft Remedial Action Report. The Respondents shall prepare and submit to the RPM, within one hundred eighty (180) days of the Final Inspection, the Remedial Action Report, in accordance with the fact sheet entitled, *Remedial Action Report, Documentation for Operable Unit Completion*, Publication 9355.0-39FS, June 1992. The report shall summarize RA events, performance standards and construction quality control, construction activities, final inspection, certification that the remedy is operational and functional, O&M expectations, and RA costs.

8.2.2 Prepare/Issue Final Remedial Action Report. Within thirty (30) days after receipt of EPA comments, the Respondents shall prepare and submit the final Remedial Action Report to the RPM.

8.3 Operation and Maintenance Training.

The Respondents must ensure adequate training for O&M staff and, if necessary, shall support all necessary training of the long-term O&M staff.

8.4 Operation and Maintenance (O&M)

For seven hundred thirty (730) days after submission of the Start-Up Report, the Respondents shall operate and maintain the groundwater containment and treatment system, including performing all necessary monitoring, according to the approved procedures in the Final O&M Manual. Hydraulic containment performance standards must be achieved within three hundred sixty-five (365) days after submission of the Start-Up Report. If necessary, as described in Section 8.3, the Respondents shall also coordinate with EPA to ensure that all personnel responsible for long-term operation and maintenance after the two year period are properly trained on the procedures and requirements in the O&M Manual.

9.0 Periodic Review

9.1 Monthly Reports

After initiation of O&M activities, the Respondents shall prepare Monthly Progress Reports for submittal to EPA on the fifteenth (15th) day following the reporting period. The Monthly Report shall, at a minimum, include: a description of O&M activities; a summary of all analytical results; calculations of the projected chemical usage and equipment replacement for the UV/oxidation treatment system; calculations of the projected life of the carbon units and projected dates of carbon unit changeouts; a summary of any operations problems encountered, corrective actions taken or planned and other related issues; results of performance calculations including example calculations; a summary of gallons of water treated and pounds of contaminants removed; copies of field monitoring forms; and copies of laboratory analytical reports.

9.2 Effectiveness Report

The Respondents shall submit an Effectiveness Report within ninety (90) days after each year (365 days) of required O&M. Therefore, the first report shall be submitted within four hundred fifty-five (455) days after submission of the Start-Up Report, and the second report shall be submitted within eight hundred twenty (820) days after submission of the Start-Up Report. The report will define the zone of capture for the treatment system, assess hydraulic effects of the system operation, evaluate effects of the system on concentrations of VOCs in groundwater, review the system performance including such estimates as total volume of water treated and mass of VOCs removed, document all data collected and associated trends, document regular maintenance work and repair work, and document any problems encountered with the system. The report shall define the sampling and data collection methods which are used determine that the contaminant mass is being fully captured along its entire width and depth. The report shall also offer recommendations to the adjustment of the treatment system to ensure optimum performance and remedy requirements.

Attachment 1
Summary of Minor Submittals and Major Deliverables for the Remedial Action at
Motorola 52nd Street, Operable Unit Two

SECTION	SUBMITTALS AND DELIVERABLES	NO. OF COPIES	DUE DATE (calendar days)	ESTIMATED EPA REVIEW PERIOD (working days)
1.3.8	Conversation/Meeting Notes	4	2 days after conversation/meeting	NA
2.1.1	Notification of Supervising Contractor (List of Alternate Contractors) (Second Notification of Supervising Contractor)	4 4 4	30 days after UAO Effective Date (15 days after EPA Disapproval) (30 days after EPA Authorization to Proceed)	15 days after receipt of notification 15 days after receipt of list NA
2.1.3	Site Visit Report	4	10 days after site visit	10 days after receipt of report
2.1.5.1	Draft RA Work Plan	4	30 days after EPA Authorization to Proceed	60 days after receipt of Draft Work Plan
2.1.5.3	Final RA Work Plan	4	21 days after receipt of EPA comments on Draft RA Work Plan	15 days after receipt of Final Work Plan
2.2.1	Status Reports	4	Monthly and as directed by RPM	NA
4.1	Draft Revised Site Management Plan (SMP)	4	45 days after EPA Authorization to Proceed	30 days after receipt of SMP
4.1	Final Revised SMP	4	10 days after receipt of EPA comments	NA
4.1.1	Draft Revised Health and Safety Plan (HASP)	4	45 days after EPA Authorization to Proceed	30 days after receipt of plan
4.1.1	Final Revised HASP	4	10 days after receipt of EPA comments	NA
4.1.2	Draft Revised Sampling and Analysis Plan (SAP)	4	45 days after EPA Authorization to Proceed	30 days after receipt of plan
4.1.2	Final Revised SAP	4	10 days after receipt of EPA comments	NA
4.2	Draft Revised Pollution Control & Mitigation Plan	4	45 days after EPA Authorization to Proceed	30 days after receipt of plan

SECTION	SUBMITTALS AND DELIVERABLES	NO. OF COPIES	DUE DATE (calendar days)	ESTIMATED EPA REVIEW PERIOD (working days)
4.2	Final Revised Pollution Control & Mitigation Plan	4	10 days after receipt of EPA comments	NA
4.3	Draft Revised Construction Quality Assurance (CQA) Plan	4	45 days after EPA Authorization to Proceed	30 days after receipt of plan
4.3	Final Revised CQA Plan	4	15 days after receipt of EPA comments	NA
5.1	Construction completion and operational testing	NA	365 days after approval of Final Work Plan	NA
5.3	Construction Completion Notification	4	15 days after construction completion & operational testing	NA
6.1	Draft Operations and Maintenance Manual (O&M)	4	300 days after approval of Final Work Plan	NA
6.1	Draft Revised O&M Manual	4	30 days after construction completion & operational testing	30 days after receipt of report
6.1	Final O&M Manual	4	30 days after receipt of EPA comments	NA
7.1.1	Pre-Final Inspection Report	4	30 days after Pre-Final Inspection	NA
7.1.2	Construction Completion Report	4	15 days after Final Inspection	
7.3	Start-Up Report	4	30 days after completion of Start-Up	NA
8.2.1	Draft Remedial Action Report	4	180 days after Final Inspection	21 days after receipt of report
8.2.3	Final Remedial Action Report	4	30 days after receipt of EPA comments	NA
9.1	Progress Reports	4	Monthly and as needed by RPM	NA
9.2	OU2 Effectiveness Report	4	90 days after each year (365 days) of O&M	NA

Attachment 2

Regulations and Guidance Documents

The following website contains information regarding the quality assurance regulations and guidances that are available: www.epa.gov/region09/qa/index.html. The following list, although not comprehensive, comprises many of the current regulations and guidance documents that apply to the RA process:

1. American National Standards Practices for Respiratory Protection. American National Standards Institute Z88.2-1980, March 11, 1981.
2. CERCLA Compliance with Other Laws Manual, U.S. EPA, Office of Emergency and Remedial Response, Vol. 1, August 1988, OSWER Directive No. 9234.1-01 (PB90-272535) and Vol. 2, August 1989, OSWER Directive No. 9234.1-02 (PB90-148461).
3. Close Out Procedures for National Priorities List Sites, U.S. EPA, 1995, OSWER Directive No. 9320.2-09 (PB95-963241).
4. Community Relations in Superfund — A Handbook, U.S. EPA, Office of Emergency and Remedial Response, 1992, OSWER Directive No. 9230.0-3C (PB92-963341).
5. A Compendium of Superfund Field Operations Methods, U.S. EPA, Office of Emergency and Remedial Response, EPA/540/P-87/001, August 1987, OSWER Directive No. 9355.0-14 (PB88-181557).
6. Data Quality Objectives Process for Superfund, U.S. EPA, Office of Solid Waste and Emergency Response, EPA/540/R-93/071, September 1993, OSWER Directive No. 9335.9-01A.
7. Engineering Support Branch Standard Operating Procedures and Quality Assurance Manual, U.S. EPA Region IV, Environmental Services Division, April 1, 1986 (revised periodically).
8. EPA Requirements for Quality Assurance Project Plans for Environmental Data Operations, U.S. EPA Quality Assurance Management Staff, Draft Interim Final, August 1994, EPA QA/R-5.
9. EPA Requirements for Quality Management Plans, U.S. EPA, Quality Assurance Management Staff, Interim Final, QA/R-2.
10. Federal Acquisition Regulation, Washington, DC: U.S. Government Printing Office (revised periodically).
11. Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA, Interim Final, U.S. EPA, Office of Emergency and Remedial Response, October 1988, OSWER Directive No. 9355.3-01 (PB-89-184626).
12. Guidance for the Data Quality Objectives Process, U.S. EPA Quality Assurance Management Staff, EPA QA/G-4, September 1994.
13. Guidance on EPA Oversight of Remedial Designs and Remedial Actions Performed by Potentially Responsible Parties, U.S. EPA Office of Emergency and Remedial Response, EPA/540/G-90/001, April 1990 (PB90-226069).
14. Guidance on Expediting Remedial Design and Remedial Action, EPA/540/G-90/006, August 1990 (PB90-273871).
15. Guidance on Remedial Actions for Contaminated Ground Water at Superfund Sites, U.S. EPA Office of Emergency and Remedial Response, 1988, OSWER Directive No. 9283.1-2 (PB89-184618).
16. Guide for Conducting Treatability Studies Under CERCLA, U.S. EPA, Office of Emergency and Remedial Response, November 1992, OSWER Directive No. 9380.3-10 (PB93-126787).
17. Guide to Management of Investigation-Derived Wastes, U.S. EPA, Office of Solid Waste and Emergency Response, Publication 9345.3-03FS, January 1992.
18. Health and Safety Requirements of Employees Employed in Field Activities, U.S. EPA, Office of Emergency and Remedial Response, July 12, 1982, EPA Order No. 1440.2.
19. Methods for Evaluating the Attainment of Cleanup Standards: Vol. 1, Soils and Solid Media, February 1989, EPA 230/02-89-042 (PB89-234959); vol. 2, Ground water, July 1992, EPA 230/R-92/014 (PB94-138815).
20. National Oil and Hazardous Substances Pollution Contingency Plan; Final Rule, Federal Register 40 CFR Part 300, March 8, 1990.
21. NEIC Policies and Procedures Manual, EPA-330/9-78-001-R, May 1978, revised August 1991.
22. NIOSH Manual of Analytical Methods, 2nd edition. Volumes I-VII for the 3rd edition, Volumes I and II, National Institute of Occupational Safety and Health.
23. Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities, National Institute of Occupational Safety and Health/Occupational Health and Safety Administration/United States Coast Guard/Environmental Protection Agency, October 1985.

24. Permits and Permit Equivalency Processes for CERCLA On-Site Response Actions, February 19, 1992, OSWER Directive 9355.7-03.
25. Procedure for Planning and Implementing Off-Site Response Actions, Federal Register, Volume 50, Number 214, November 1985, pages 45933-45937.
26. Quality in the Constructed Project: A Guideline for Owners, Designers and Constructors, Volume 1, Preliminary Edition for Trial Use and Comment, American Society of Civil Engineers, May 1988.
27. Remedial Design/Remedial Action (RD/RA) Handbook, U.S. EPA, Office of Solid Waste and Emergency Response (OSWER) 9355.0-04B, EPA 540/R-95/059, June 1995 (PB95-963307).
28. Revision of Policy Regarding Superfund Project Assignments, OSWER Directive No. 9242.3-08, December 10, 1991. [Guidance, p. 2-2]
29. Scoping the Remedial Design (Fact Sheet), February 1995, OSWER Publ. 9355-5-21 FS.
30. Standard Operating Safety Guides, U.S. EPA, Office of Emergency and Remedial Response, 1992, OSWER Directive No. 9285.1-03 (PB92-963414).
31. Standards for the Construction Industry, Code of Federal Regulations, Title 29, Part 1926, Occupational Health and Safety Administration.
32. Standards for General Industry, Code of Federal Regulations, Title 29, Part 1910, Occupational Health and Safety Administration.
33. Structure and Components of 5-Year Reviews, OSWER Directive No. 9355.7-02, May 23, 1991. [Guidance, p. 3-5]
34. Superfund Response Action Contracts (Fact Sheet), May 1993, OSWER Publ. 9242.2-08FS.
35. TLVs-Threshold Limit Values and Biological Exposure Indices for 1987-88, American Conference of Governmental Industrial Hygienists.
36. USEPA Contract Laboratory Program Statement of Work for Inorganic Analysis, U.S. EPA, Office of Emergency and Remedial Response, July 1988.
37. USEPA Contract Laboratory Program Statement of Work for Organic Analysis, U.S. EPA, Office of Emergency and Remedial Response, February 1988.
38. User's Guide to the EPA Contract Laboratory Program, U.S. EPA, Sample Management Office, August 1982.
39. Value Engineering (Fact Sheet), U.S. EPA, Office of Solid Waste and Emergency Response, Publication 9355.5-03FS, May 1990.

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- Complete items 1 and/or 2 for additional services.
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3. Article Addressed to:

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3102 North 56th St.
Phoenix, AZ 85018

4a. Article Number

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4b. Service Type

- ☐ Registered ☒ Certified
☐ Express Mail ☐ Insured
☒ Return Receipt for Merchandise ☐ COD

7. Date of Delivery

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Paula Sprague

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